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SINCLAIR QL WORLD

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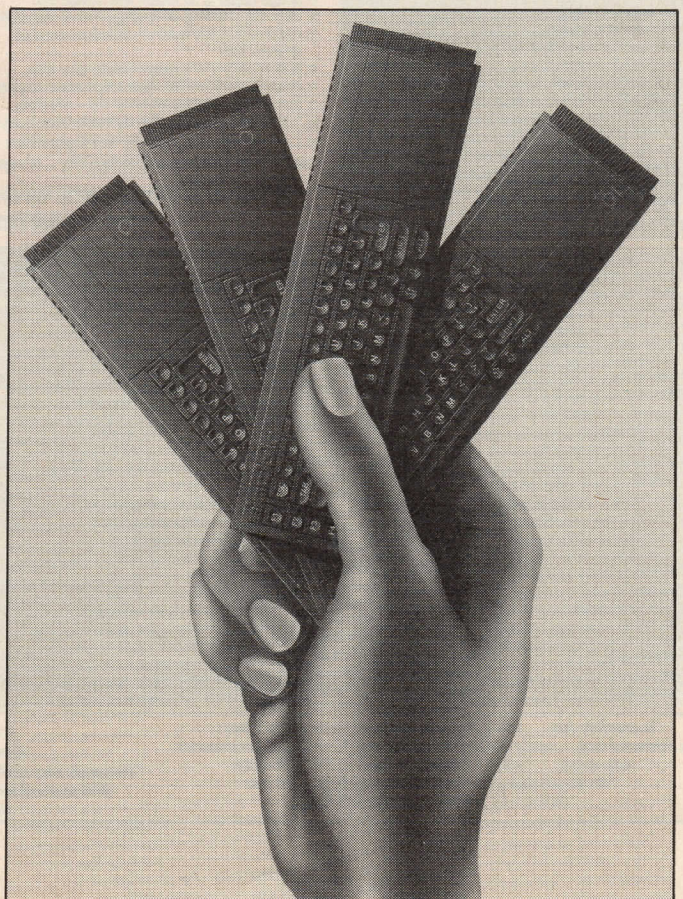

NEXT MONTH

The Thor 20 Super Computer

The latest release from CST is the upgrade to the Thor, the Thor 20. The new machine is bigger and faster, but with a hefty price tag. Is it worth it? Bryan Davies investigates.

DIY Toolkit

The popular DIY Toolkit is back. Having collated your ideas for extensions to SuperBasic, we are now ready to continue our series of useful commands.

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DP Classic

TURBO V1.14

THOR COMPATIBLE

"Dramatic . . . . bug free . . . . an excellent program . . . a great advance on Supercharge . . . . more capable (than the latest version of QLiberator) . . . . the fastest SuperBASIC compiler so far . . . . mind-bending . . . . takes SuperBASIC and the QL into a new era . . . . With TURBO we should start to see programs which are unthinkable on any other small micro"

Upto 100X speedup on BASIC! QL WORLD, April 1987

☆ Supremely fast – even QL World's independent benchmarks, which do not use **TURBO**'s speed-optimisation options (which give a further 100% – 150% speed increase), show a 230% (yes – TWO HUNDRED AND THIRTY!) speed increase over the latest version of QLiberator. We can demonstrate speed improvements that are far greater, and the speed of compilation itself is typically 100% + more than on QLiberator.

☆ Supremely concise -- even QL World's size benchmarks, which do not use **TURBO**'s size optimisation or diagnostics off options (which yield a further 40% saving in code space), show that **TURBO** generates more concise tasks than QLiberator!

☆ Supremely compatible – **TURBO** compiles virtually anything you care to throw at it. Full auto-corrector built in, takes interpreter bugs in its stride, warns you if you've been too naughty.

☆ Supremely easy to use – a beautiful front-end, on-screen help, instant abort, no LENSLOK, window adjustable during compilation, multitasks while compiling, adjustable buffer size/window copying/DATASPACE from front-window, user configurable to avoid boring keybashing, adjustable report file (to screen/printer/file etc.) in full or condensed format, etc.

☆ Supremely flexible task communications – use PRINT and INPUT to communicate between any number of multitasking jobs – even arrays can be passed, and channels can be shared! Option strings can be passed as parameters of EXECUTE.

☆ Supremely free from restrictions – you can use procedures or functions in any task from any other task! Generate tasks as large as the QL's 640K RAM – or go down the modular route (we supply a program to help you) and instantly link any number of modules.

☆ Supremely Servile (!) – **TURBO** lets you choose between switching diagnostics on/off (off = shorter code), and between setting optimisation to global speed/localised speed (on a statement block basis) ★ size ★ size with localised speed ★ none, a total of 15 options. You are in the driving seat. If you slip up, we give you a report that pinpoints your mistake, exact to the character!

☆ Supremely feature-filled: Virtual arrays, rubber arrays, implicit datatypes (accelerated, fully re-entrant integer FOR loops and integer/STRING SELECT on all QL s), full WHEN – ERROR trapping of any error on any QL version to a single point (error handlers – you can have any number of them, hierarchically laid out – have full access to line and error numbers, and you can RETRY or CONTINUE RESTART as you choose) even when in another task, parameter passing by reference as well as by value, 9 digits of displayed accuracy, etc.

☆ Supremely powerful **TOOLKIT** included, with **ONE HUNDRED AND EIGHTY (!!!)** really useful commands, utilities and functions for the BASIC programmer. There is no space to even begin to list them – suffice it to say that **TURBO TOOLKIT**'s most 'comprehensive' rival has little more than half as many features. The **TOOLKIT** (which is RAM based) is designed to complement existing toolkits (e.g. the Supertoolkit) as far as possible.

☆ Supremely documented – a **THREE HUNDRED AND FIFTY A4 PAGE,** lucid, illustrated user encyclopedia.

☆ Supremely generous – there are no royalty restrictions on **TURBO**'d programs.

The TURBO System costs £99.95 COMPLETE

TURBO IS BRILLIANT. PRESS COMMENT FROM EVERY SOURCE IDENTIFIES IT AS THE MOST OUTSTANDING BASIC COMPILER FOR ANY MICROCOMPUTER.
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BETTER BASIC EXPERT SYSTEM

This does what its title implies, and its use is in analysing, correcting and annotating programs written in SuperBASIC or programs in other BASICs to be translated into SuperBASIC. BETTER BASIC is user-configurable and very easy to use.

"Excellent – a 5 star program" SINCLAIR USER, December 1986
"Intelligent – does well what it sets out to do" QL World, Jan. 1987

THOR COMPATIBLE

BETTER BASIC costs £24.95 complete with manual

£5 OFF if you are also ordering TURBO or SUPERCHARGE

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"A runaway success – SUPERCHARGE is dangerously close to being a completely over-the-top raver . . . performance is simply dramatic . . . the final spark that sets the QL software scene alight . . . SUPERCHARGE really shows that you can do things on a QL that you can't on other machines" **YOUR SINCLAIR**
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★ Automatic (semi-auto on disks) recovery of deleted files
★ Bulk recovery of corrupt files to new files
★ Header block or Disk type information display
★ String searching by sector or file – ultrafast
★ Direct file copying from other disk formats (PC-DOS, MS-DOS, CP/M, Acorn DFS etc. etc.) – sector copying to other disk formats.
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£59.95 Complete with huge manual, or £69.95 with Astronomer

SUPER ASTROLOGER £24.95

"Incredibly fast . . . unnervingly accurate even on default files . . . a powerful tool . . . easily the best & most powerful astrology program for any micro . . . I would strongly recommend it" **QUANTA**
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"Succeeds very well . . . an excellent program . . . you certainly will not find as good an astrology program as this on any other home computer" **QL USER/QL WORLD**

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DIGITAL PRECISION DESKTOP PUBLISHER

DP Classic

THOR COMPATIBLE

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"Superb . . . . it exceeds feature specifications found in even the best word processors presently available . . . . natively multitasking . . . . you will actually look forward to using Editor (this never happened with Quill!) . . . . you are in complete control . . . . seldom have I ever come across a program which positively scintillates with such due care and attention" . . . . QL World, January 1987.

The Editor is amazing – a few of its features are summarized below:
☆ Speed improvements of the latest edition of the EDITOR over Quill are simply ridiculously good – load-time improvements of 25 times, block-handling improvements of over 100 times, deletion improvements of 50 times, searching improvements of 100 times, paging improvements of 100 times, copying improvements of over 1000 times, etc. . . .
☆ Flexible – Editor can load and handle text, Quill documents, SuperBASIC programs, listings in assembler or high level languages, QL screens, data files, machine code object files, alien format files caught by Media Manager, even Editor itself(!) – and you choose your own fonts too.
☆ Feature-packed – an independent count of features yielded QUILL **14**, METACOMCO ED **17**, **EDITOR 65** (!!) (Ask DP for a factsheet if you are a sceptic!)
☆ Here's a mind blowing option – Editor allows you to create command files (using ANY/ALL of the 102(!) commands) for subsequent execution. In the SPECIAL EDITION, these command files can have up to nine parameters each . . . . pause & think what can hence be accomplished!
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☆ Now with a new all-singing, all-dancing printer driver – lets you start where most Editors stop!
☆ Lucidly documented – new larger manual.

There are two versions of EDITOR – one that will work on any QL, and a SPECIAL EDITION with dozens of additional features but which needs at least a 128K RAM expansion

DP Classic

EDITOR costs £29.95

SPECIAL EDITION EDITOR costs £39.95 complete

THOR COMPATIBLE

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Two artistic but provocative demo screens supplied – prudes stay clear!!

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"Up to now, the last word in graphics packages for the QL has been from Talent. EYE-Q has more features, is considerably easier to use, and is also about half the price!" POPULAR COMPUTING WEEKLY

DP Classic

EYE-Q costs £29.95 complete with lucid A4 documentation

EYE-Q is fully compatible with DP's new DESKTOP PUBLISHER

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"The sprites produced are very good" **POPULAR COMPUTING WEEKLY**
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"Succeeds very well" **QL WORLD**
"The Definitive FORTH . . . excellent . . . very fast . . . user-friendly . . . the best" **QUANTA**

SUPERFORTH costs £39.95 complete with 100 page A4 manual

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Sinclair QDOS Companion

The QDOS Companion, by Andrew Pennell, one of the most prolific authors on the QL, is essential reading if you are interested in programming the QL in Machine Code. It describes all the functions of QDOS, and gives details of all the TRAPs, and VECTOR calls. It includes details on how to access the keyboard, screen, serial ports etc. from machine code, how to communicate with the 8049 co-processor, and how to write multi-tasking programmes and lots more. £6.95

QL Service Manual

The QL Service Manual is the book issued by Sinclair Research to QL repair companies, and contains all you need to know about the QL Hardware. It has full circuit diagrams including the microdrives, details on various chips and their functions, block diagrams, fault finding and lots more £19.95

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QL SCENE

New Front Page

The desk-top publishing system *Front Page* has been updated. The latest release is fully Thor-compatible, allows blocks of on-screen inverse printing for both text and graphics, and supports character sets made from *Eye-Q* and the Pyramide *Nucleon.* Bold character sets are now saved as a separate file.

The improved graphics dump allows double-pass printing for increased image density — up to 200 dots per inch — and the facility for multiple copies. The 8056 thermal printer, sold with the QL by Dixons, has been added to the list of Front Page-compatible printers.

A new routine has been provided to make a new set of _temp files, used by Front Page for its external scratch-pad memory.

For further details contact Gap Software, 17 St John's Terrace, London E7 8BX.

Thor 20 available soon

CST has announced its new Thor computer, the Thor 20, which will be available soon.

The system is based on the Motorola MC68020 32-bit processor and is available with an optional MC68881 floating point co-processor — the Thor 21 — as well as a choice of two clock speeds, 12.5MHz and 16.7MHz, compared to the 7.5MHz of the 8-bit Thor.

In addition to the increased clock rate there should be time savings in two other areas. One is because of the architecture of the MC68020, which includes an on-chip instruction cache, a fast local memory which holds recently-accessed intructions. The next time the instruction is executed, which is often soon afterwards, it does not need to be fetched from main memory, saving considerably on execution time.

Second, the floating point co-processor will give a dramatic improvement in any programs using floating point values. That includes the majority of SuperBasic programs and any programs using the utility vectors, including screen graphics.

All prices are quoted as upgrades to the existing Thor machine, making the new Thor 20 an expensive piece of equipment. The introductory price for the 12.5MHz version is £600 excluding VAT, or £425 without the co-processor. The 16.7MHz version will cost around twice that price.

Shadow set

Shadow Games is to launch a new adventure/graphic system which looks set to compete in the same market as *The Quill* from Gilsoft.

At present in the beta-testing stage, the system consists of a number of modules. The *APT Adventure Writer* includes facilities for text compression and real-time events. A graphics module, *Graphics Designer,* can be used as a stand-alone graphics program or as a source of linkable illustrations.

A third module contains a number of useful toolkit additions for amateur and professional games enthusiasts.

The inclusion of a graphics module will give the package a big advantage over The Quill which, as yet, does not include *The Illustrator* in the QL version.

Finally, a fourth module, which is being developed, will permit games writers to compose adventures on the QL, then cross-compile them for the Atari ST and Commodore Amiga. The extra market that will create should ensure an ample supply of high-quality adventures on the QL for many years.

Heart of Gern

A new text adventure game has been released by Profile Computer Business Systems. Called *The Heart of Gern,* it revolves round your quest for the jewel of the title.

It is the first in a planned series of adventures all set in the Princelands, a totally consistent fantasy world, which was designed originally for a role-playing campaign. The second adventure, which will deal with how to get rid of the jewel once you have found it, is already being written.

Further details from PCBS, Studio 204, Seedhill Offices, Paisley, Renfrewshire PA1 1JN.

Cash Trader re-release

PDQL has re-released its *Cash Trader* and *PDQ Payroll* packages, reviewed in this issue. Continuing its support for the products, PDQL has extended the Cash Trader Support Service. In the new arrangement PDQL provides a hotline and workshop service for Cash Trader users, giving advice on the use of the system, assisting with file recovery in the event of a crash, and modifying or adding to the program routine to suit specific needs.

A support service for PDQ Payroll users is also available.

For further details contact PDQL, Unit 1, Heaton House, Camden Street, Birmingham B1 3BZ.

Real-time spelling checker

Sector Software, better-known for its *Task Master* multi-tasking package, is to release a real-time spelling checker for Quill soon. Written by Peter Jefferies, the author of Task Master, Spellbound will check Quill, and probably *The Editor,* text against a dictionary of more than 30,000 words.

This may be expanded further by the user, subject only to the media/memory limitations. The choice of 30,000 is the amount which can be squeezed on to a single Microdrive. This implies that this product is of use only to QL owners with memory expansion. The exceptional feature of Spellbound is that it works in real-time. It will check input on a character-by-character basis, letting you know as soon as you make a mistake. It might be expected that this would slow things, but Sector Software claims that the system is totally transparent to the user. Best estimates give a speed of around 8ms to check the dictionary.

Further details are available from Sector Software, 39 Wray Crescent, Ulnes Walton, Leyland, Lancs PR5 3NA.

OPEN

Open Channel is where you have the opportunity to voice your opinions in *Sinclair QL World*. Whether you want to ask for help with a technical problem, provide somebody with the answer, or just sound off about something which bothers you, write to: Open Channel, Greencoat House, Francis Street, London SW1P 1DG.

Microdrive madness

I would like to relate the details of an interesting exercise I performed recently on my QL. Apart from my QL, I also possess a ZX Spectrum, which has a Microdrive attached. As I no longer use the Spectrum, I decided to connect the ZX Microdrive to the QL via its expansion slot. To my dismay, when I referred to the introduction section of the QL User Guide, I noted the following:

"This slot is for attaching up to six more QL Microdrives. ZX Microdrives are not suitable for use with the QL . . ." Despite this piece of sage advice, I proceeded with my original intention and, to my surprise and relief, the QL and ZX Microdrive worked without problems. Since this connection, the ZX Microdrive has been used for some time and its performance is identical to that of the existing Microdrives.

Have any other QL users managed to complete this exercise successfully? Are there likely to be any problems with this set-up which I have not appreciated? I would be very interested to hear any views on this matter.

T. P. Lobert,
South Woodham Ferrers,
Essex.

Project language

I am writing to ask for advice. I am undertaking some system software design as a project for a post-graduate diploma and I would like to extend my experience in this area by doing more programming at home. I have an unexpanded QL which is not going very much at the moment, so I thought it about time I used it for something useful.

My problem is choosing a suitable language, at a reasonable cost, which is fairly easy to use and can be interfaced with Qdos. I do not really want to use C, though I use it at college for my project, because I think its syntax is horrible; I thought BCPL would be more reasonable. By all accounts it is easier to read, though I have never seen it. What do you think?

James Bannon,
Paisley.

Editor's reply: BCPL is more verbose than C, though it still works along similar lines. Certainly for your uses, I could recommend it. I would suggest that you look at the language first. You are one of the few people I have met who has used C and does not like it. The Metacomco BCPL Development System, which you suggested you might buy, recommends reading* BCPL — The language and its compiler *by Martin Richards and Colin Whitby-Stevens, published by Cambridge University Press.

Insomniacs anonymous

How about adding some extra pages to The Progs? Not for every issue, just now and again. Do not say you cannot find room, because you can always shorten some stories. Keep the good old *QL World* alive.

Matti Saarnela,
Finland.

I have a bit selection of QL software but cannot afford too much. I think the QL is still one of the best-value machines on the market but would like more software for it. The programs you print in *QL World* are very good, some of them nearing commercial standard. Would it be possible to include more programs?

Alternatively, it would be even better if you could print some longer programs, rather than just putting them on Microdrive Exchange.

S. McGuire,
Manchester.

Editor's reply: We are always concerned about increasing the length of programs in The Progs section. The longer they are, the more chance of error. You are correct about not only the quality but also the quantity of readers' software. We have more than 200 programs to sort through, many of which are extremely good. In an effort to please we have included an excellent Space Trading game in The Progs section of this issue.

Toolkit error

With reference to the DIY Toolkit article in the March, 1987 issue and the SuperBasic Hex Loader in particular. Having checked the program carefully several times I find, on running it, that an error statement "at line 300 End of File" occurs. Comparing the assembly code listing to the hex data. I noticed that locations 0106, 011A, 0120, 1029 and 102E were missing from the hex data. To my dismay, including the in the Hexloader made no difference. The same error is listed as before. Perhaps you would investigate my problem and advise? I would also appreciate it if you could explain how the DATA 350 statement at line 560 is deduced.

W. H. Sambrook,
Great Barr,
Birmingham.

Editor's reply: Taking your last question first, the DATA statement in line 560 tells the computer how much memory to allocate to save the new extension. This value is read by the READ statement in line 150. The four zeros at the beginning of line 690 represent the 0106 locations. You are correct in thinking that the other locations are missing. Unfortunately line 700 was missed from the final copy. It should read:

```
700 DATA
"2C29272724221F
1D1B1B1917151412
100F0F0E0C0B0A090
908070605".""*""
```

The '*' at the end of this tells the computer that it has reached the end of the data. The omission is the reason for your error.

You will also find that the checksum should have been included immediately after the asterisk and that is also missing. To avoid this, delete lines 470 to 510 and line 530.

Sinclair comment

I must agree with your correspondent, Frank Gutteridge — April Open Channel — concerning the usefulness of the QL. Mine happens to work well and I would never have bought an 8-bit machine of any kind. Had the QL been marketed properly, it would have sold much better than was the case. When I sought to buy one, three requests to Sinclair Research for a specification were ignored and finally I paid only £100 for my (new) machine.

It is obvious that Sir Clive Sinclair, like many businessmen, is so paranoid that he unjustly blames everyone but himself for his misfortunes. He has, however, been successful in his main objective, to amass a large fortune.

L. G. L. Unstead-Jones,
Edinburgh.

Editor's reply: It is pleasing to hear from so many people who still think the QL is an excellent machine. Surely the originator of the machine is not so bad as you suggest, is he?

CHANNEL

Faster than a speeding QL

I wonder if you could ask Marcus Jeffrey to suspend publication of the Puzzle Page for a few months? During that time perhaps he could explain how his QL is so much faster than all the others. My copy of the April issue of *QL World* arrived late and I found that the diminishing response time for puzzles had finally reached zero, requiring the answer to reach your offices on the day I saw the puzzle.

I like puzzles. I positively glory in them, enjoy entering competitions, and have even won prizes. Yours are usually good competitions and I would like to have a chance to enter them. Therefore could you please ask Jeffery to ADATE the clock on his QL to allow a reasonable time, say two or three weeks, for entries?

Jim Henry,
Belfast,
N. Ireland.

Editor's reply: I apologise for the late running of the magazine recently, which has caused the anomaly in the puzzle dates. You may have noticed that we have dropped the Puzzle Page temporarily, as you suggested, which should give people sufficient time to get entries to our offices. Not only was there a diminishing response time to the puzzle page but also a diminishing response. Are there many readers who enjoy this feature of the magazine? If so, which puzzles did you find most interesting? Please let us know.

Cash problems

Could you assist me with a number of problems I have encountered when using the *Cash Trader* program on my QL? First, I must add that I have very little knowledge of computers and even less of the technical phrases used.

Having bought Cash Trader to use for my launderette accounts and followed the instructions given in the manual, I had no problems until I had filled the current work cartridge. The instructions given to carry forward on to a second cartridge did not work.

I also have a Queen-Data DWP1120 printer and found it will not work with Cash Trader. Instead, when I pressed 'P' to print, the carriage went to the right and printed on a single spot. I wrote to the Cash Trader support service but my letter was returned by the Post Office. I understand that Accountancy Software has sold Cash Trader to another company. I now have no idea what to do, and I hope you can be of assistance.

J. Lord,
Cleethorpes,
S. Humberside.

Editor's reply: You are correct in thinking that Cash Trader has been sold. It is now marketed by PDQL, including an enhanced version. It also runs a complete support service, details of which are given in this month's QL Scene.

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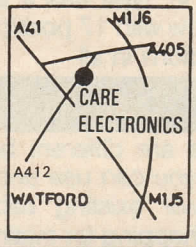

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TROUBLE

A PROBLE

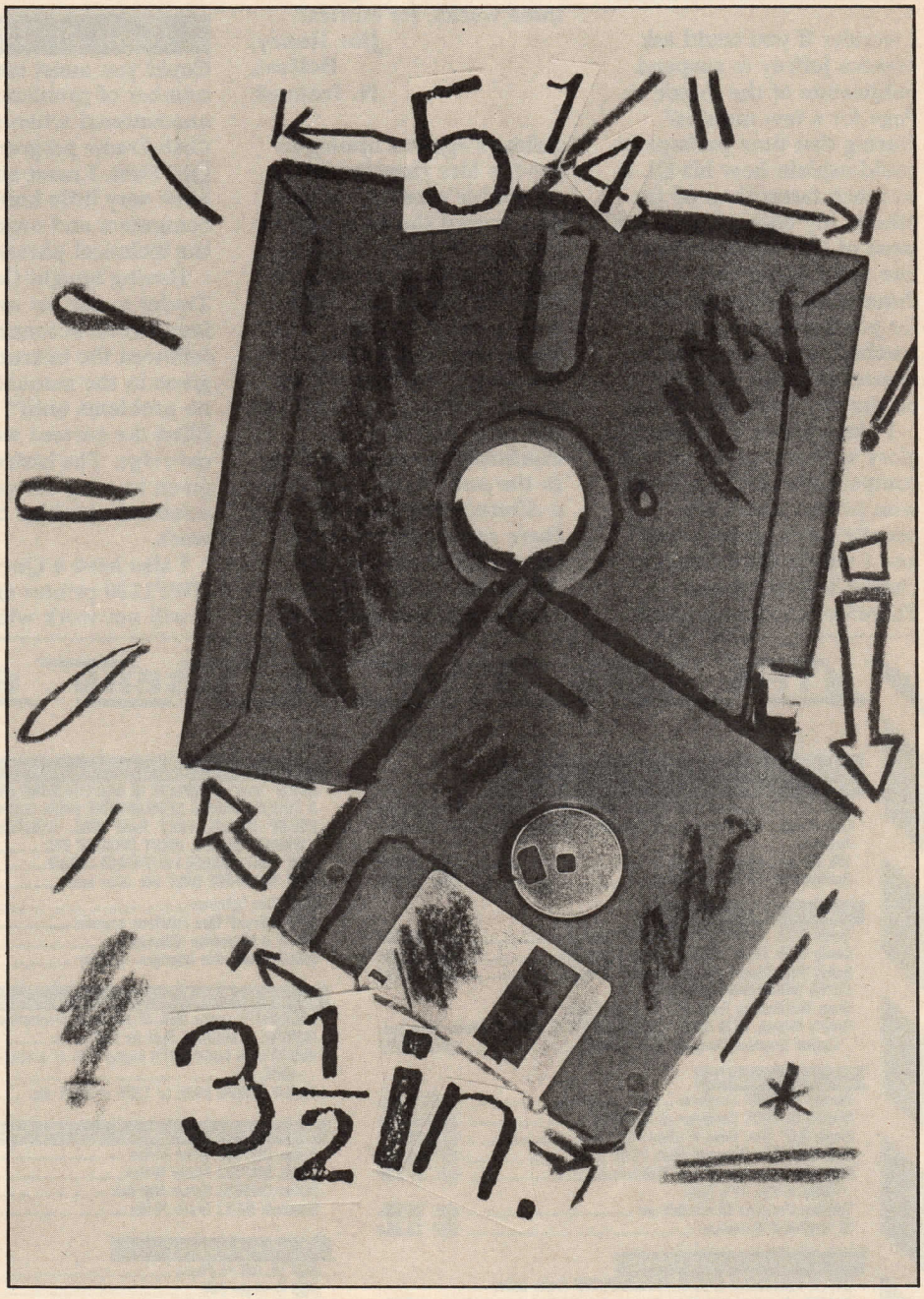
A problem shared is a problem solved by Bryan Davies, the QL World Trouble Shooter

Two suppliers mentioned in a previous article have still not responded to requests for information on readers' complaints. They are 4 Systems and Portfolio Software.

Alan Phillips is having problems with the Impact accounts suite; do any readers have advice? The problem is corruption occurring when month-end runs are made.

A few tips on problems you might meet. Do you need to use both 5¼ in. and 3½ in. discs? You might expect that both sizes can be connected to the same interface, because that impression has been given previously, but it is not so easy. The chances are that the connectors used on the drives are incompatible; the 3½ in. drives will probably have the same type of male connector as the interface, but the 5¼ in. drives will have a different male connector.

If you want to use one drive of each type, take a standard ribbon-connecting cable for dual drives of either type, remove one of the drive connectors and replace it with the other type. The replacement has to be female, 34-way, in either case, but the 3¼ in. type has two rows of 17 sockets each, whereas the 5¼ in. type has a single, double-sided row with 17 positions, making 34 connections in all.



Disc decisions

There are different brands of connector you can use and it is safest to take your existing cables with you when shopping for mating connectors. Radiospares Speedbloc range has the 3½ in. type; note that the disc interface male connector may have locating notches at three points on one side and the mating cable connector should have mating notches.

The other way of ensuring connection is made the right way round is to use the stripe down the side of the ribbon cable as a guide; that is at the end where connections 1 and 2 are, which is nearest to the front of the QL on my PCML interface and on the left side of my Mitsubishi one-third-height drives. Having made the physical connection, you may be faced with another problem—the interface may view all drives as being the same in terms of number of tracks, and your 'old' 5¼ in. drives could be 40-track, whereas 3½ in. ones are more likely to be 80-track.

That does not mean you cannot use both on the same system but you will have to accept operating in '80-track mode', in which case the 40-track drive(s) will be unusable—or in '40-track mode'—and only half the ca-

SHOOTER

M S O L V E D

pacity of the 80-track discs will be used.

If you are copying files from one size to the other, it is possible to transfer files subsequently from 3½ in. 40-track discs to 80-track ones by normal Copy command. On the PCML interface, the command <flp_opt> can be set to <flp_opt 2,30,40> to allow 40-track 5¼ in. disc files to be transferred to 3½ in. discs formatted to 720 sectors, then changed to <flp_opt 2,30,80> to allow the 3½ in. 40-track copies to be transferred to discs formatted to 1,440 sectors.

Networking

The QL networking commands have been regarded as fairly useless but you can use them to copy files from drive to drive, if you do not fancy making the mechanical connections described. The basic QL allows only one-at-a-time file copying, however, which can be rather a strain, and it is preferable to use Tony Tebby Toolkits, to allow use the the "wild copy" command to copy all files from a disc with one command.

Having just spent several fruitless hours trying to do this, be warned that the instructions you read may not be clear enough to enable you to do the job immediately. One approach is to enable the Toolkits, if necessary—e.g., key-in <TK2_ext> for the Sandy interface(s) and then key in <NET 1> on the "master" QL and <NET 2> on the other.

Follow this by <FSERVE> on the slave, to which copying is to be done. That links the two QLs in a network and you can key-in <WCOPY flp1_,n2_flp1_> to the master to copy all the files from its drive to the slave QL drive. The <> signs should not be keyed-in. Make sure the drive/medium capacity is either the same, or greater in the slaves. When copying between microdrives and disc drives, the command <NFS_USE dvc> can be used to change the effective device name.

More of my time is spent dealing with incompatibilities than in doing gainful work and I suppose that is true for many people. The list seems endless. Have you discovered that you can buy continuous A4 paper? If you have changed from the standard continuous paper — quarto — to A4, have you had difficulties persuading the printer to start at the top of the next page after printing one page?

Try to decide in what order print actions take place; what messages reach the printer and what is it pre-set to do? There may be a DIP switch in the printer, which is set for either 11in. or 12in. length of paper — quarto or A4 roughly. This switch can possibly be over-ridden by software commands, so that the setting is not critical. A4 paper is 297 mm long — about 11⅔in. — and six lines per inch — the "0" setting for Gap in the Quill Design command — gives a maximum of 70 lines, in theory. The default Quill printer-driver setting is for 66 lines, the same as the default Page setting in the Design command, and that means that you will not get more than 66 lines unless you change the printer-driver.

Printer settings

Alter the setting to 70 lines, to allow full use to be made of the paper; you do not have to print so many, as the Design command allows you to set the Upper and Bottom margins to give fewer lines of print, or allow for the shorter quarto paper. The printer will not step to the top of the next page if a one-page document is printed unless that document consists of the maximum number of lines — text or blank. I prefer to set my printer-drivers for cut sheet, as that allows me to abort a print run at any page; if you dislike pressing the Enter key after each page, put a heavy weight — I use a small magnet — on the Enter key when the first message appears; do not leave it for too long or you will have a number of blank lines at the end of the document when printing has finished.

Alternatively, some switching programs give you the option of printing as a background job and deciding whether or not you want to stop after each page, e.g., with Q_Switch, using the normal program-switching keying of SHIFT + CAPS LOCK will allow moving to another job while the print is done from Quill without stopping, whereas moving to the other job by using CTRL + C then SHIFT + CAPS LOCK causes the "NEW SHEET OF PAPER" message to appear over the current job screen, requiring you to press Enter after each page.

Q-electronics

A QL user in India asked where the QL service manual can be obtained. It is mentioned in some advertisements in *QL World,* but I obtained mine from the QL enthusiast mentioned at the end of this article. The cost of £20–£25 is rather expensive if you are not really interested in electronics, and you might find the book gathering dust on the shelf after a few minutes' reading, but I have found it helpful on several occasions and do not regret buying it.

It is perhaps most useful to owners of pre-D11 QLs because it gives details of modifications which should be made to them. Reference is made in the manual to a test cartridge called "Systems Test 2" and I find the test useful to have available when something is done to a QL and you want to check it. No test equipment is required — just two blank cartridges. One recent use has been to find how to connect an Atari joystick with a "D" connector to a "German" QL which has D connectors for both SER and CTRL ports.

B. Martley wrote saying he had not received a RAM expansion board ordered from Rainbow Digital Repairs and the company has replied indicating that it returned his money after receiving a letter from him. The problem was that the company's suppliers produce only small batches of this item and could not supply one at the time. Rainbow has been let down previously by the same supplier.

Printerland and Chromagraphica have not replied to requests for information. Would those suppliers please write to me in connection with readers Hardie, Baskaran and Mortenson?

QL Service Manual
Dennis Briggs
Adman Services, 53 Gilpin Road,
Telford
Shropshire TF5 0BG
Tel: 0952 55895

Emulating CP/M

CP/M emulation could open a vast library of new software for the QL. New horizons? Ron Massey investigates.

CP/M, an acronym for Control Program for Microprocessors and developed in the early 1970s by Dr Gary Kildall for Intel 8080 CPU-based micros, has long been regarded as a likely candidate for a QL add-on. While a number of software houses have long considered developing a system for emulating CP/M on the QL, for a variety of reasons this has failed to materialise previously.

A tremendously exciting product by any standards, the Hallmark *CPMulator,* supplied in EPROM and software — both of which have to be available to run CP/M programs — emulates an 8080/Z-80 microprocessor environment in the QL, enabling users to take advantage of the tens of thousands of CP/M programs, both commercial and those available from a large number of CP/M user groups world-wide.

The emulator is designed specifically to be run with virtually any QL configuration but the display works only in monitor mode, 80-column and 24-lines. An optional printer is supported, as are other devices such as a modem connected to the ser2 I/O port.

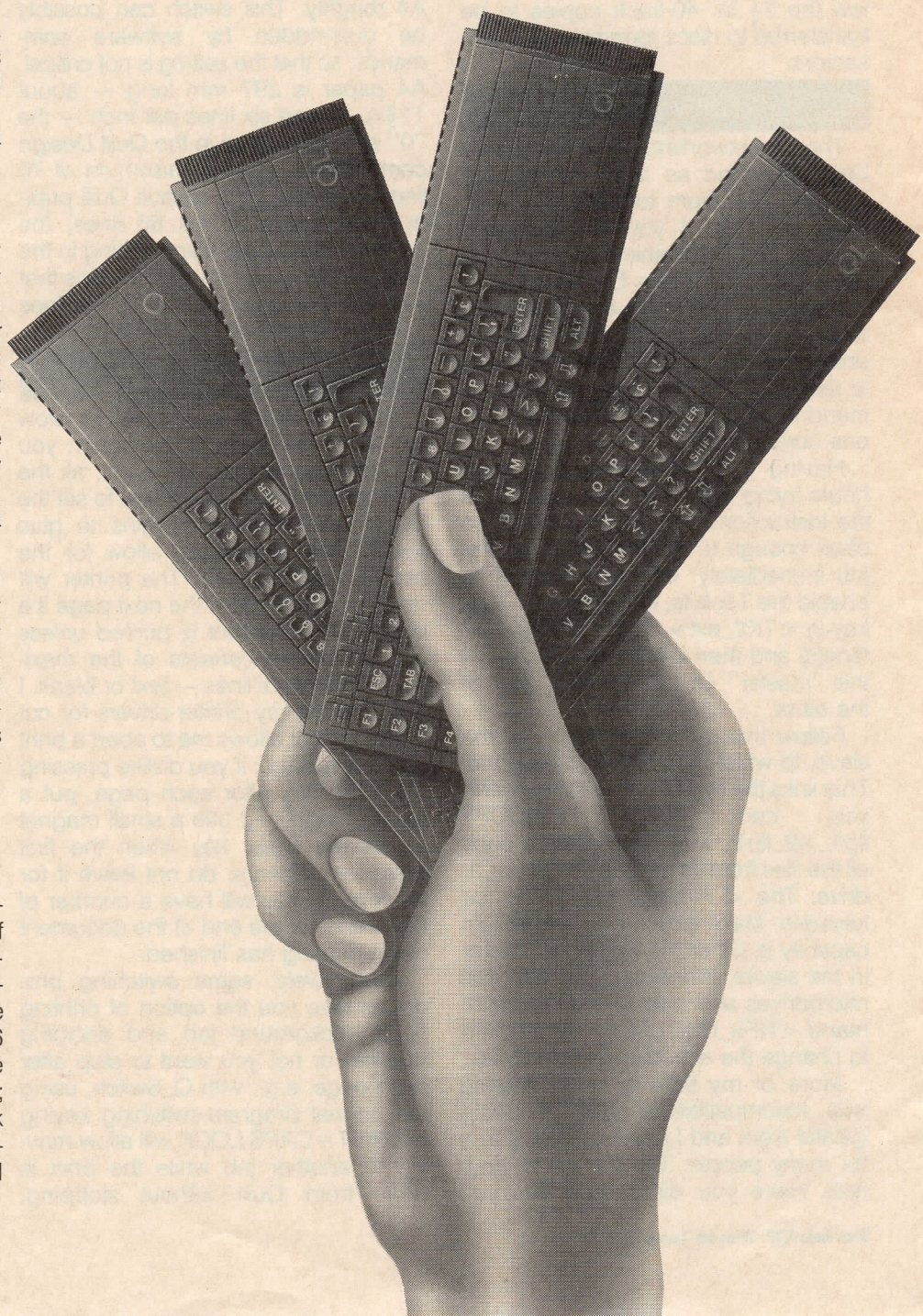
Ten commands

Once up and running, CPMulator provides 10 resident commands for initial user interface, a few of which are similar to those available with *Super Toolkit II. DIR* and *DIRS* are directory commands; the former produces a list of file names, while the latter is similar to the TK II *WSTAT. REN* is a re-name command; *ERA* is used the same way as *delete. ERQ,* similar in application, will query whether or not to delete a named file.

A point worth noting is that although Microdrives can be used with the emulator and are an interesting if somewhat unusual environment for CP/M, because the Qdos trap for re-naming files on Microdrives does not work, renaming files with the *REN* command is confined to disc systems unless a toolkit which allows for the TRAP#3 with D0=4A is available.

No native language

TYPE is used as the QL native command *copy drive_filename to scr* or, if a toolkit is available, the *view* command. *SAVE* is a little more CP/M-specific in that the command will save a specified number of pages of 256 bytes, each in a given file. *CLS* is the same as the SuperBasic command; *TIME* will display day, date and week until another keypress. The final command is *QDOS:* this will stop the CP/M emulator and return control to Qdos.



In common with the majority of computer systems, except for Sinclair computers, CP/M does not incorporate a language native to its operating system. Because of that the language is loaded, like any other program, prior to running utilities, compilers and so on. Generally, CP/M extensions take the form more reminiscent of toolkit utilities.

Features, in terms of language and command structure, which have become familiar on the QL have a distinct parallel in CP/M programs. Many of the features found in the Psion programs share common idiosyncracies with CP/M conventions.

Most notably, the Psion filename structure, with a maximum of eight characters followed by a delimiter and three characters, is mandatory, while the only limitation of CP/M is an eight-character maximum filename length. The delimiter, followed by three characters, is optional.

Compatability

CP/M programs, such as the industry-standard *WordStar,* observe all the usual CP/M conventions with regard to command keys and program flow. Some key combinations for command functions are evident on IBM-type keyboards *SCROLL UP* or *SCROLL DOWN,* which generate a QL equivalent of <CTRL><R> or <CTRL><C> has been translated into the more familiar <SHIFT><DOWN> and <SHIFT><UP>, respectively, by the emulator.

Approximately 70 percent of *CPMulator* consists of an interpreter for the Z-80 or 8080 program code. Because the structure of this code differs greatly from the QL 68008 processor, a number of instructions cannot be interpreted.

It is fortunate that CP/M programs generally do not use these particular instructions which, in any case, deal mainly with special hardware features pertaining to particular machines.

Unfortunately, QL graphics cannot be used with the emulator. In any case, the majority of CP/M machines do not include code for graphics routines and, unless you have GSX available, that is one limitation which will have to be accepted.

An estimated 70 percent of all 2.2 CP/M software will run on the QL. Hallmark has checked a number of commercial programs prior to the release of its emulator and recommends the following:

Turbo Pascal (Borland); faster than a popular interpreting Pascal for Qdos.

Pascal MT+(Digital Research); a good choice for experienced programmers.

WordStar (MicroPro); runs at about the same speed as Quill and is reliable. A very powerful word processor, some commands run faster than Quill.

Basic-80 (Microsoft); interpreter and compiler.

Macro 80, Link 80, LIB-80 (Microsoft); a good assembler package for developing Z-80 or 8080 programs.

DDTZ; similar to the ZSID (Digital Research) or GEMDEBUG (Gemini Computer Systems) debugger.

CP/M programs

Since many CP/M programs expect to work with a terminal which supports special features, such as cursor addressing or attributes, CPMulator contains a screen driver which handles the screen in the manner of a terminal.

CP/M programs requiring installation for the machine on which they are to run usually include a range of terminal options. Where that is the case, users should select the terminal ADM 3A as their choice.

CPMulator requires that CP/M files be prefaced by the QL copyright symbol (<SHIFT><ESC>). When files are transferred from non-QL media, using the *RDCPM* utility, filenames will appear in the directory listing as, for example, *filename.ext* and must be transferred as *(c)filename_ext.*

Installing the emulator for your system requires that the *instal_bas* program be run. By answering the screen prompts, you can assign a Qdos directory device to any of the 16 logical CPMulator disc drives; a Qdos character device — ser, par — to the CPMulator printer *LST;* a Qdos character device to the CPMulator auxiliary device *RDR* and *PUN.*

Installation

As supplied, the emulator is configured as drive A = flp1_, drive B = flp2 and drives C to P = flp1. The length of the directory device name is limited to four characters. Device names, limited to 22 characters, default to LST = ser1hr, RDR = input from ser2ir, PUN = output to ser2ir.

When in use, the emulator requires that printer baud rates be set in boot programs. It is recommended that, where extensive use of I/O is made, RAM disc is used instead of conventional drives.

If you already have or acquire CP/M programs from any of the many sources, such as user groups, you will need to convert them into the QL disc or Microdrive format. Supplied for this purpose, the *RDCPM* routine will do this for you, for most CP/M source discs, automatically.

One of the problems with CP/M is that computer manufacturers failed to adopt a disc standard from the onset for $5\frac{1}{4}$in. drives. The result is that there are now literally hundreds of disc formats available, among which are ACS, Acorn, BBC/CPM, Amstrad, Ampro, BT Merlin, Future, Orion, Kaypro, IMS, ICS, ICL, Memotech, Nascom, NEC, NewBrain, Olivetti, SuperBrain, Sanyo, Sharp, Wang, Westrex, Xerox and Zenith. If you wish to transfer files from discs to either:

GEMQDDS, a popular system adopted by Gemini Computer systems and available through Europe;

ATARI ST CP/M, used by the Atari ST CP/M emulator;

JKCPM+ — popular for European industrial applications;

SuperBrain DD35 — used by the Intertec SuperBrain some years ago — formats, you can install one of the format conversion files from the *RDCPM* menu and copy CP/M source files on to a QL-formatted disc or Microdrive.

Disc formats

Programs in other disc formats can also be transferred but require some additional work by the user. Selecting option 6 from the *RDCPM* menu, you are prompted for a drive number for the CP/M source disc. After a brief period of analysis, the screen display indicates information concerning the disc — density, sector length, first sector start position, number of sectors per track, number of sides, number of tracks per inch, number of tracks per disc.

The user is expected, for lack of a better description, to guesstimate sector skew — sector-read sequence; data inversion or not; number of reserved disc tracks; block size; number of directory blocks and side mode.

The primary goal is to obtain a coherent directory of the files on the CP/M source disc and, with a little experiment, the parameters can be set correctly for the source media format, enabling file transfer to the QL media. A number of suggestions are made in the documentation as starting points for each parameter.

Although the process appears complicated, in practice incorrect parameter selections will produce a directory which includes varying degrees of rubbish, according to how far off are the parameters. Once a sensible directory is obtained, a menu option enables the user to save the transfer parameters as a file for use on other CP/M discs formatted in the same way.

File transfer is made by selecting each file number to copy and entering a file name, in the QL format by *(c)file-*

name_ext, using an underscore, rather than the CP/M conversion of an eight-character file-name followed by ''.'', and the optional three-character appendix.

While copying a group of CP/M files, using the transfer utility I noticed that, where the source file is greater than 64K, a directory of the CP/M source disc will show two files of the same name. When that happens and the file is copied to the QL disc, the system appeared to concatenate two files. That occurrence is only an apparent anomaly and, when such a file is examined, subsequently everything worked as would be expected.

Although *RDCPM* will transfer CP/M files successfully to the QL format in the majority of cases, it is not able to cater for all disc formats. Where possible, users are advised to ask programs to be supplied in the more common formats.

A powerful utility program, MENU-.COM — a directory of the disc from Qdos will show the file name as *(C)MENU_COM* — has been included with CPMulator to enable efficient housekeeping for copying, printing or re-naming files and directory control.

A number of commercial programs have been adopted as standards for the CP/M user. Among them *Peripheral Interchange Program* permits the interchange of data between many pairs of peripheral devices; *ED* is the standard CP/M line editor.

User groups

In addition to the many commercial programs, a few of which include *WordStar, Spellstar, Datastar, Perfect Writer, dBase II* and a tremendous range of languages and related utilities, a number of U.K. user groups, such as PD Software, 90 Braybourne Close, Uxbridge, Middlesex UB8 1UJ, offer membership and catalogues of the various titles available. Other PD Software services include five bulletin board systems for messages and downloading of software.

When approach is made to a user group, it will need to know the name of the disc operating system in which you would like to have the CP/M volumes formatted. My first disc from PD Software was supplied in the GEM.Qdos format, on 3½in. disc and the *RDCPM* utility transfered from the data from the CP/M disc with no difficulty.

Regular group meetings are held near Heathrow airport. The current catalogue contains more than 1,600 discs of IBM PC and CP/M software, containing tens of thousands of individual titles and around 25 new volumes are added to the collection each month.

Quoting from the short-term catalogue, ''...CP/M material is mostly non-machine specific and the bulk of it will run on any CP/M machine. Discs are sold in volumes, where a volume is defined as a disc containing about 240K of CP/M code. This may mean two large programs and several small utilities, but some discs contain 100 or more individual items.''

CPMulator TK Computerware,
Stone Stacy, North Stanford,
Ashford, Kent CT28 6DF.
Tel: 0303 812801.
£34.95

CP/M library

Many of the public domain programs, put into user group libraries for distribution, are available on a try-before-you-buy basis. Titles from such groups include subjects for every level of user applications software, such as word processors or databases, of a standard rivalling commercial programs costing hundreds of pounds; aids and supplementary utilities for commercial programs; games; and languages such as C, Basic, Pascal, Fortran, Cobol, Forth, Assembler.

CPMulator is, without reservation, an exciting product and almost literally provides the QL with an alternative operating system, along with a host of new professionally-produced programs.

For the user of off-the-peg programs, the emulator will open horizons, with a completely new range of software. What will eventually become apparent is that CP/M, like QL SuperBasic, is an extensible language to which commands may be added by starting-up additional routines — in effect, somewhat like adding extensions, procedures or functions to SuperBasic. Without the addition of routines, CPMulator is limited to its 10 primary commands.

For the programmer, several Basics and a wide range of compilers and other programming tools are available which provide a flexible and adaptable system for particular applications.

Because CP/M is interpreted on the QL, programs generally tend to run somewhat slower than would be the case in native CP/M environment. Although WordStar, for example, does not run any faster than Quill, its command structure is very powerful and, in many ways, combines the features found in a text editor with a few other options for good measure. WordStar incorporates a number of very useful commands. Among them is the option to have the printer control codes used for underlining, font changes — such as bold, sub or superscript — displayed or not, a feature common to word processors available on other computer systems and performed by graphic means in Quill.

A number of minor limitations are imposed by CPMulator. One is that PAR_USE ser emulation available in a number of disc I/Fs and toolkits does not work; expecting a printer to be connected to a serial port, if hard copy is required, a serial port will have to be used. Further, attempting to emulate a serial port can produce unpredictable responses in WordStar.

Initially, I felt that the documentation could have been expanded to include more information for users new to CP/M but, after reading the manual twice, it soon became apparent that it more than adequately covered the salient points of the emulator system and, in any case, is not intended to be a CP/M tutorial.

Background

Anyone interested in acquiring background for CP/M programming or applications can read any of the many excellent books on the subject. Two CP/M books are particularly recommended — *Using CP/M,* by Peter Gosling (MacMillan) and *CP/M Programmer's Encyclopedia,* by Bruce Brigham (Que).

In spite of its title, Encyclopedia deals more with the use of CP/M than programming. The section dealing with MBasic includes a keyword summary at the end of the chapter. From both the beginners' and the experienced computer users' point of view, the two books cover the basic material for the CP/M user admirably and assume only minimal knowledge of the system. *Using CP/M* includes a number of programming examples in MBasic, ASM — one of several CP/M assemblers.

Hallmark has done a good job with CPMulator for providing an alternative operating environment for the QL.

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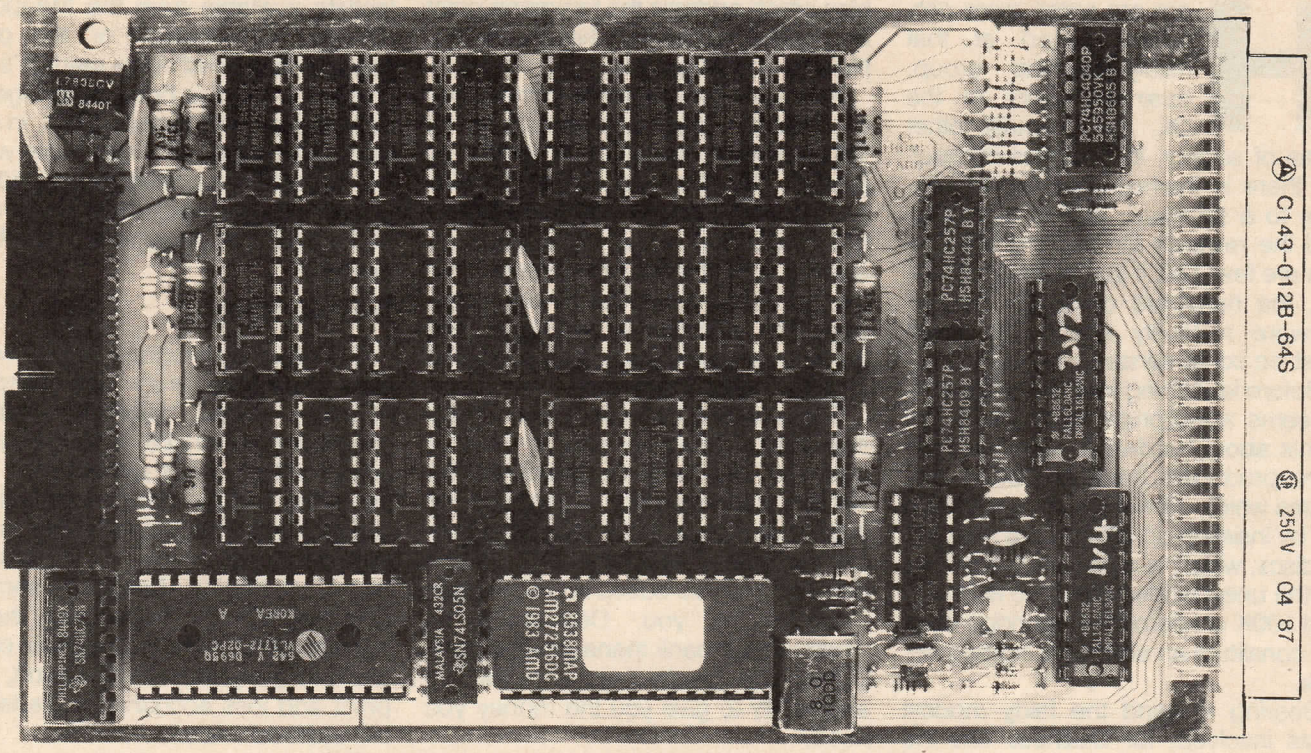
- Memory Cut



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MICRO BUSINESS SOFTWARE

In the final part of our business software survey James Lucy discovers how to produce a business plan, process a company payroll and generate VAT returns.

Here are some more programs aimed at that mildly-eccentric group, business users of the QL. As in most other areas of society, in business computing there is intense pressure to conform to a standard, IBM in this case, and the rewards for bucking the system are few. Still, if you already have a QL, the hardware costs are nil and software relatively cheap, so there must be some sense in the idea.

Before launching into the programs, it seems appropriate to make a few points about hardware. Very few software producers have produced programs which will not run on a standard QL by insisting on either extra memory or discs, which is a pity since memory on the unexpanded machine is limited and 100K of Microdrive cartridge does not constitute an adequate storage device.

Bearing in mind the fairly modest costs involved, for business use the minimum hardware complement should be considered to be 640K of memory and a single floppy drive; 3½in. discs are best for their added durability and reliability and, of course, they have just been adopted on the new IBM Personal Computers, so blank disc prices should be on the way down, and it is pleasant if the disc interface includes a parallel port and print buffer. That broadens the choice of printers and allows two printers to run at once, one perhaps loaded with pre-printed order stationery and the other with invoices.

If you are using a standard machine you could consider trading it against a CST Thor or one of the other compatibles which address the foregoing point and add a reasonable keyboard, too. Now for the programs.

Entrepreneur is another in the series of business programs produced by Triptych and marketed originally by Sinclair. The other two, *Decision Maker* and *Project Planner*, were discussed last month and found to be good examples of their kind. Entrepreneur has the same format as the others, copy-protected Microdrive cartridges and an A5 ring-bound manual all contained in a hard plastic slip case.

The product has two aims. First it sets out to teach the way in which a business idea may be examined for viability and, second, it provides an application program which will generate cashflow predictions and various forms of analysis based on information provided by you. Depending on whether your bank manager likes computers, the results may impress him sufficiently to give you the money you need.

Documentation

The documentation plays a major part in Entrepreneur. The bulk of the manual is concerned with the teaching phase and is designed to be read while working through the program at the QL. Fortunately, the book is well-designed, well-written, and produced to a high standard and so some of the horrors of trying to read while sitting at your computer are avoided.

The teaching program and the book together go through a number of topics which are relevant to the production of a business plan. All the information could be obtained from other published sources, such as the leaflets available from the Manpower Services Commission or the publications mentioned in the manual's bibliography, but this book pulls together the various considerations well. In addition, the tyranny of a computer which will not continue unless you provide an answer offers considerable incentive to make sure that all aspects have been covered.

Double entry

The teaching program begins with a look at double entry book-keeping, revenue, assets, liabilities, balance sheets and sundry other such financial complications. All is explained in simple terms and the process by which a lobster turns into pound notes is animated on the screen — in financial terms, of course. Following sections continue with the crustacean theme, adding credit, fixed and variable costs, work in progress, depreciation, and profit and loss accounts to the tale of the seafood's fate.

By the time you have progressed through break-even analysis, VAT, working capital, tax and balance sheets you will have survived a crash course in small business administration. Even such subjects as exceptional selling points, third-party rights, market research, competitors and human resources are mentioned in the manual at least.

Once you have learned all about business you can get down to it. Two applications programs are provided. The one you choose depends on the number of products you intend to market. The purpose of the application program is to assist you to analyse your business idea. Before you can

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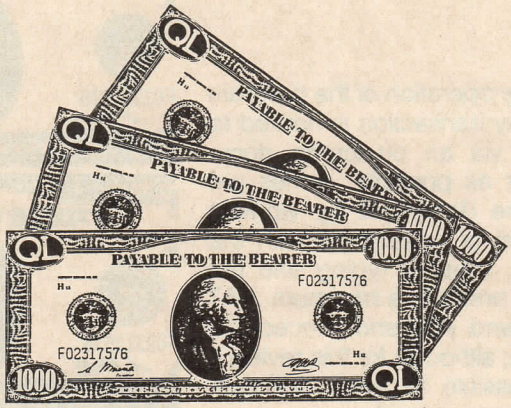


run it, you will need to accumulate information about the proposed business; needless to say, the results of the analysis are only as good as the data you provide, which should put paid to any rose-tinted idea that the computer could provide assistance which was in some way magic.

The information required is all entered in response to prompts, which makes the process easy; once the data is in, and since some of it, like sales volumes figures, will have demanded a fair degree of crystal-ball work, the real value of the computer becomes apparent as you play what if? to your heart's content.

Sensitivity analysis allows a spreadsheet-like examination of what happens to post-tax profits when 10 percent changes are made to various elements in the business data. If the profits react strongly, one way or the other, the element changed must be watched carefully when the business is in operation.

Strong bearing

On the other hand, if an element which has a very strong bearing on profit is highly unpredictable, it might be that the whole business idea is too risky. A further routine, ratio analysis, gives three more important figures, creditors and debtor turnover, and percentage return on nett assets. The first two have a bearing on cashflow and the return on nett assets is, of course, what the business is about. If it is not more than you could get by putting your investment in a deposit account, why bother working?

Entrepreneur has more tricks still. Break-even analysis is a useful technique which reveals the underlying relationship between fixed and variable costs, profit margins and sales volumes, and the all-important cashflow calculation is automatic, if rather slow in operation.

Available at around £25, Entrepreneur represents a sound investment for someone considering starting a business. It has problems — it is rather slow, being written in SuperBasic, it is copy-protected, and the printing and reporting facilities are limited in scope and restricted to owners of Epson-compatible printers.

It is comprehensive, well-presented and documented, and provides a very good primer in business administration. For that reason, it would perhaps be ideal for use in training establishments, as well as for budding businessmen. It is a generous product which will not leave you feeling short-changed, Triptych includes appendices in the manual which contain useful information difficult to obtain elsewhere and it is recommended.

Cash Trader is another of those QL packages with a long and chequered history. The package, designed for keeping the accounts of small businesses trading largely on a cash basis rather than on credit, was produced originally by Accounting Software Ltd and advertised under the allow 28 days for delivery phrase as early as September, 1984. By February, 1985 it had made the transition to a Sinclair-endorsed product, albeit under the Quest name, and was distributed in the black plastic boxes which were then in vogue.

When it eventually became available in the kind of quantities required to satisfy demand, it cost £70 and even at that rather high price sold reasonably well. Cash Trader worked fairly well too, apparently, although it had a stupid copy-protection scheme and problems in talking to printers. Still, bearing in mind the initial marketing targets for the QL of small businesses keen to computerise their administration at low cost, the product was very important to the QL and, had it been more timely, could have converted thousands of small business owners to the religion of the black machine.

Since then, Cash Trader has soldiered on but with a severe hiccup on the demise of Sinclair as we knew it. That disrupted the back-up provided originally by the Sinclair support contractors at Camberley and a package like this without support is virtually useless.

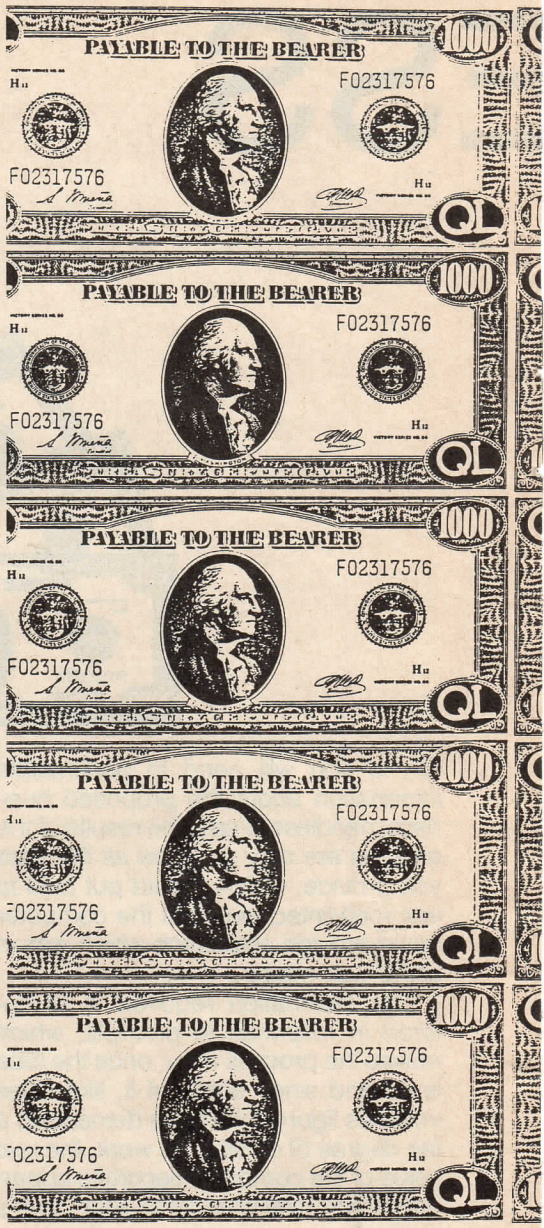
Incredibly, all now seems well. Birmingham-based software house PDQL, in collaboration with Charles Dillon, who is becoming almost ubiquitious in the QL field these days, have negotiated a deal with Quest which allows it to produce an updated version and to provide support. For existing users the new version is available at a concessionary price and is compatible with data files created under the old system. We were able to look briefly at the new version for this review.

Cash Trader is intended to be a very easy-to-use, practically foolproof system for businessmen who have limited knowledge of accountancy, typing or programming. It keeps business accounts in a way which should be acceptable to the accountant and the taxman, generates the figures for VAT returns automatically, and maintains a profit and loss account and balance sheet.

The P&L and balance sheet are displayed on the screen and are updated continually as new information is entered, a pleasant feature not possible in a manual system.

The program is supplied on Microdrive or disc and will run on an unexpanded QL. On the new version, any printer which will work with the QL, serial or parallel, can be used. The documentation was not available at the time of the review, although PDQL says that it will be an edited version of the old manual, with some material added and some of the more patronising passages removed. Despite its rather variable level, the old documentation was well-suited for its target clientele and clearly presented. PDQL

MICRO BUSINESS SOFTWARE
Continued



will need to do well to improve it.

To get Cash Trader running, the first thing is to run the configuration routine, a new and welcome feature. It allows the device names — flp1, mdv1 and so on — to be set for the programs and data and the details of the required printer to be set up. Serial or parallel ports can be used and the baud rate can be set as and if required.

Cash Trader

Next, a number of parameters used by Cash Trader need to be determined. They relate to the number of transactions you want on one data file, the number of analysis groups, and the number of analysis heads under each group. The old system was limited to 14 groups of 10 heads; the PDQL version allows almost any combination of heads and groups provided their product does not exceed 999. Naturally it is not possible to analyse retrospectively, so a user upgrading from the old version will need to think carefully about the way he makes use of the extra heads.

Finally, within configuration, the maximum number of lines on any one document may be set to between 10 and 30. Each date entry into the system is made via a specially-numbered document which contains the individual transaction detail.

Once the system has been configured, you need to work through the examples before being allowed to launch into the program proper. The compulsory process of setting the system date has been simplified and is now much faster although I do not see why you cannot just type it in. When you begin to use the system for your accounts there is a hurdle to surmount — you need to set up your own group and analysis names, details of the 10 supplier and customer accounts, and bank details.

That process, along with the preparation of opening balances, is vital to the satisfactory operation of the system and to the acceptance of the output by auditors and the taxman. Consequently it is likely to require an accountant's advice.

Day-to-day operation of the program is simple; any transaction is notified to the system via an on-screen document; as far as possible, entries are made on the document by working through a list of possibilities with the cursor keys, keeping typing and the likelihood of errors to a minimum. VAT period-end and year-end procedures seem simple, although for this review it was not possible to enter sufficient data to try them properly.

Printed reports on the information held can be obtained by making selections from the reports menu. The list is rather restricted, limited to VAT, documents, P & L, balance sheet and trial balance; in 1984 we were promised a reports module which has yet to appear.

PDQL appears to have done a very good job on Cash Trader. It has been compiled using Turbo, which makes the program fast and allows reasonable error trapping, and the main objections to the old version have been overcome. The improvements include the end of the silly key cartridge in Microdrive one, better back-up and restore facilities, configurability to a wider range of hardware, and greater freedom with analysis heads.

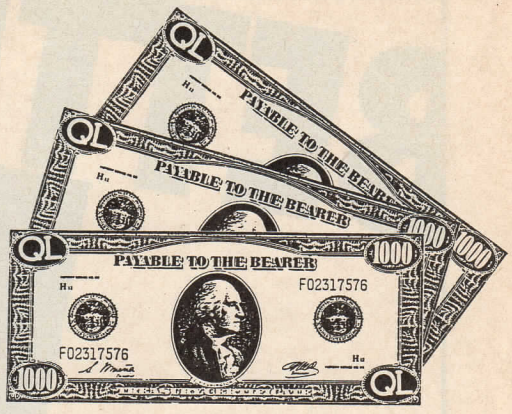
True personality

The nature of an accounts program means that it needs to be used for a long period in a business environment before its true personality is revealed and most of the bugs are flushed out. Clearly that was not possible with this preview of the latest version of Cash Trader but the omens seem good. PDQL offers the new version to existing users for £40 including documentation detailing the improvements;the cost to new users including full documentation is £80. One year's membership of the support service costs £15 and allows a specified number of telephone and workshop enquiries.

PDQL Payroll, another package in compiled SuperBasic, is again intended to solve a particular category of problems endured by the businessman, the processing of weekly or monthly payroll. Manual preparation of a payroll is a very tedious affair, as anyone who has had to do it will tell you. Weekly and monthly staff present sufficient problems and require you to spend hours poring over impenetrable tax and National Insurance tables, but hourly-paid workers multiply the complications several fold, particularly where there are variations in their hours of work. PDQL Payroll addresses all those problems and hence must hold considerable attraction for some businessmen.

For £70 you receive about 200K of programs on the selected media, including a large Quill document containing the instructions for using the package. The programs and files are divided so that they can be paged-in if required from Microdrives 1 and 2, but the system operates far better from disc and it is difficult to imagine that a business would find running from Microdrive acceptable.

Similarly, Payroll can operate on an



unexpanded machine, although for this review extra memory was used to run a fast RAM-disc containing the system files. In this configuration the program really flies.

As with Cash Trader, and Entrepreneur for that matter, it is incorrect to assume that everything will be easy because it is on computer. There needs to be a considerable investment in time in setting-up files, in particular the employer and employee details and, of course, those files must be maintained to keep them up-to-date.

Faster Payrolls

Nevertheless, most data needs to be entered only once and the investment should prove more than worthwhile when a few payrolls have been run in a fraction of the previous time.

Program operation is straightforward. On start-up, the program detects if it is the first time of running and, if it is, goes through a configuration procedure which allows storage device names and other information to be entered. Once under way, all selections are made from a main menu by typing the appropriate number; the comprehensive range of routines includes the production of cheques and printing SSP reports, P60 and P35, period end updates and many other functions.

Further routines allow the NI and tax tables to be updated to accommodate post-budget changes, employee records to be printed, and an abbreviated list of employees to be displayed on the screen.

Error-trapping and validation of entries seems thorough and the program refused steadfastly to crash under any circumstances, but there were a few minor problems. If a date was entered without the required separating slashes, it was not rejected but converted into another date. The range of deductions and extra payments which could be made to an employee was very wide but the employee could not be called anything other than Mr, Mrs, Miss or Ms.

Only two digits are available for clock — employee — numbers and once one was used it could not be re-used until year-end, a good incentive to keep down staff turnover. The documentation needs improvement; the presentation as a Quill document is not very satisfactory on a product of this price and it was rather cryptic and over-concise in places.

Attractive program

All in all, though, PDQL Payroll is a very attractive program. It is reliable, presumably due to the error-trapping made possible by its compilation, and fast for the same reason. It is sufficiently flexible to meet most small business needs and, as an added bonus, can read data files from perhaps the most-used QL payroll package, that from TR Computer Systems. Users of the TR system will find the operation of PDQL Payroll very familiar but will be very favourably surprised by the extra speed of operation.

PDQL offers a support package for an annual fee of £15, which would seem a very worthwhile investment, bearing in mind the complexity of the subject and the frequent changes which occur in pay legislation. PDQL Payroll is recomended but, as with Cash Trader, you would be well advised to discuss your needs with PDQL before purchase.

We have now reached period end. It has been possible to look at a few of the programs available for business on the QL and, with the three strong contenders this month, coupled with the best of last month's crop, we hope to have shown that the QL can be a very useful tool in running or establishing a business.

Many other programs are available, ranging from blockbusters like *Sage Accounts* to small but useful utilities like *KeyDefine*. If business users would like more food for thought, please let us know.

BETTER BASIC

Unlocking the RAM

Mike Lloyd finds useful information locked in the QL memory.

Much of the information which a computer needs to interpret and run programs is held in read-only memory. The contents of ROM are permanent and unchangeable, even when the computer power is turned off, which is why it is not necessary to load SuperBasic and Qdos from Microdrive each time the computer is used. The QL also reserves large areas of random access memory to keep track of important data concerning the attributes of the screen, keyboard, Microdrives and other devices.

Of the QL 128K RAM, only 85K is available to the programmer when the computer is switched on and as a program develops even more RAM is taken by Qdos to hold system information, thus reducing program space. Every time a screen or console is opened a block of 256 bytes of RAM is allocated to hold data such as the size, colour and position of the window. If sufficient windows were opened — there are more than 200 of them on an unexpanded QL — the data blocks would use so much RAM that there would be no room for a program.

Slave blocks

Qdos allocates RAM to hold transient programs, resident procedures, Microdrive slave blocks and a representation of the screen display, in addition to an area for a SuperBasic program. Other areas of RAM hold a number of data blocks or information tables. Apart from the 32K of screen area beginning at address 131072 the data blocks are liable to be shunted round in memory as they expand and contract to cope with the information they are required to hold. Some of the most important data blocks are:

The *name table* which holds SuperBasic keywords, extension command names, procedure and function names, file names and variable names.

The *variables area,* which holds the values which the variable names, including arays, represent.

The *Microdrive map.*

The main *system variables table.*

A *screen variables area* for each window channel.

A table showing where the other tables are located.

Some of the most interesting of the Qdos data blocks are those relating to each screen channel. Much of the information stored in each of the tables can be altered by SuperBasic keywords such as PAPER, CSIZE and CURSOR but knowledge of where to find each screen table allows programmers to select values not permitted normally by SuperBasic and to obtain information about the status of each window.

Open window

Each time a window is opened and a screen variables area is allocated, Qdos keeps a note of its start address in a table. Listing one is a function which returns the start address of a specified window by peeking an entry in the "table of tables".

Unfortunately Qdos lists windows in the order in which they were opened rather than by the channel number given to the window by the programmer. Listing one is therefore very unreliable if it is used in a program in which windows are opened and closed frequently. The solution is to begin each program by opening in correct numerical order all the extra windows which will be required.

Each screen variables area of 256 bytes is laid out in a set way, which makes it easy to calculate offsets in each area. The width of a window will always be recorded 28 bytes away from the start of the data block. Figure one lists the offsets for some of the more useful system variables.

The use to which the information available in the screen variables areas can be put depends on the ingenuity and imagination of the programmer — three examples are included in this article.

Listing two is a procedure which prints centred text. Without knowing character widths and window sizes it is difficult to position text centrally in a window. Rather than requiring the programmer to provide information about line lengths and character

Listing 1.

```
100 DEFine FuNction WIN_VARS (chan)
110 RETurn PEEK_L (PEEK_L (163960) + 4 * chan)
120 END DEFine
```

Listing 2.

```
200 DEFine PROCedure centre (chan, text$)
210 LOCal char%
220 char% = PEEK_W (WIN_VARS (chan) + 28) / PEEK_W
    (WIN_VARS (chan) + 38)
230 PRINT#chan; TO (char% - LEN(text$)) /2; text$
240 END DEFine centre
```

Listing 3.

```
300 DEFine PROCedure space (chan, gap, text$)
305 LOCal norm
308 norm = PEEK_W (WIN_VARS (chan) + 38)
310 POKE_W WIN_VARS (chan) + 38, gap
320 PRINT#chan, text$
330 POKE_W WIN_VARS (chan) + 38, norm
340 END DEFine space
```

sizes, the procedure determines the correct print position for itself by peeking the screen variables area of the chosen window.

The programmer needs only to pass the window number and the text to be printed.

This short program proves that the routine works:

```
600 FOR WIDE = 0 TO
    3
610 CSIZE WIDE, 0
620 CENTRE 1,
    "Centered Text"
630 END FOR WIDE
```

As well as peeking information from the screen variables area, information can be poked into it. Usually, character size and window attributes are changed with SuperBasic keywords and there is little point in doing otherwise. That, however, can restrict the options available to those envisaged by the designer of SuperBasic. Only four character widths are permitted by CSIZE. The characters can be only five or 10 pixels wide; the other two widths allowed by CSIZE merely increase the gaps between the characters. The space which is occupied by a character is recorded as a word 38 bytes from the start of the screen variables block and can be any value between nought and 65535 pixels. You can experiment with this feature using listing three, which requires the

Guide to screen channel system variables tables

Notes: Offsets relate to address of start of data block found by WIN_VARS function — listing one.
All co-ordinates and sizes are in the pixel co-ordinate system.

Off-set	Size	Purpose
24	Word	Horizontal co-ordinate of the top left corner (TLC) of window area (excluding border).
26	Word	Vertical co-ordinate of TLC of window area (excluding border).
28	Word	Width of window area.
30	Word	Height of window area.
32	Word	Height of border.
34	Word	Horizontal co-ordinate of TLC of cursor.
36	Word	Vertical co-ordinate of TLC of cursor.
38	Word	Character width.
40	Word	Character height.
42	Long word	Address of start of character font for CHR$(32) to CHR$(127).
46	Long word	Address of start of character font for CHR$(128) to CHR$(191).
66	Byte	Flag for UNDER, OVER, and so on.
67	Byte	Flag for cursor (0 = off).
68	Byte	PAPER colour.
69	Byte	STRIP colour.
70	Byte	INK colour.
71	Byte	BORDER colour.
73	Byte	FILL mode (0 = off).

Figure 1.

BETTER BASIC

CONTINUED

channel number, the cursor increment and the text to be printed as parameters.

Another way of exploiting this system variable is shown in listing four, which provides coloured underlining. The simple SuperBasic UNDER command is restricted to using one colour for both the character and the underline, which makes characters with descenders difficult to read. The alternative STRESS procedure is more practical and more colourful than UNDER. The parameters represent the channel, the colour of the underline and the text to be printed. It works best with large character sizes in Mode 8. An example call is:

```
900 CSIZE 3,1: STRESS
1, 75, 'gypsy'
```

The final major routine — listing five — prints-out some of the more useful system variables for any window. It begins by clearing Window #2 and providing a heading. It then lists a series of system variable descriptions obtained from DATA statements, using the slave procedure STATPRINT — listing six — and prints values obtained by peeking the data block.

The system variables described in the first DATA line are all held as 16-bit values between 24 and 40 bytes from the start address. CSIZE, OVER, FLASH and UNDER information is crammed into a single byte in which each bit has a special significance. That byte is decoded using a bitwise logical operator to detect set bits. The flat indicating whether FILL is set or re-set, however, occupies a whole byte to itself.

Further experiment will reveal other useful system variables in the screen data blocks. While peeking them will never cause a problem, poking unexpected values into some of the addresses can easily cause the QL to crash.

Listing 4.

```
400 DEFine PROCedure stress (chan, col, text$)
405 LOCal norm_col, wide, char
410 norm_col = PEEK (WIN_VARS (chan) + 70)
415 wide = PEEK_W (WIN_VARS (chan) + 38)
420 FOR char = 1 TO LEN(text$)
424   POKE_W WIN_VARS (chan) + 38, 0
425   INK#chan, col: UNDER#chan, 1
426   PRINT#chan; ' ';
430   UNDER#chan, 0: OVER#chan, 1
435   INK#chan, norm_col
436   POKE_W WIN_VARS (chan) + 38, wide
440   PRINT#chan, text$ (char);
445   OVER#chan, 0
450 END FOR char
455 PRINT#chan
460 END DEFine stress
```

Listing 5.

```
500 DEFine PROCedure status (chan)
504 LOCal offset, info$, byte
508 CLS#2: RESTORE 500
512 PRINT#2; 'WINDOW#'; chan! 'SYSTEM VARIABLES'\\
516 FOR offset = 24 TO 40 STEP 2, 68 TO 71
520   statprint
524   IF offset < 68
528     PRINT#2; PEEK_W (WIN_VARS (chan) + offset)
532   ELSE
536     PRINT#2; PEEK (WIN_VARS (chan) + offset)
540   END IF
544 END FOR offset
548 byte = PEEK (WIN_VARS (chan) + 66)
552 statprint: PRINT#2; (96 && byte) / 32
556 statprint: PRINT#2; (16 && byte) / 16
560 statprint: PRINT#2; (1 && byte)
564 statprint: PRINT#2; (2 && byte) / 2
568 statprint: PRINT#2; ((4 && byte) / 4) - ((8 &&
 byte) / 4)
572 statprint: PRINT#2; PEEK (WIN_VARS (chan) + 73
)
576 DATA  'WINDOW Xpos',  'WINDOW Ypos',  'WINDOW
width', 'WINDOW height', 'BORDER height', 'CURSOR
Xpos',  'CURSOR Ypos',  'CHAR  width',  'CHAR
height', 'PAPER', 'STRIP', 'INK', 'BORDER'
580 DATA 'CSIZE width',  'CSIZE height',  'UNDER',
'FLASH',  'OVER',  'FILL'
584 END DEFine status
```

Listing 6.

```
600 DEFine PROCedure statprint
610 READ info$: PRINT#2; info$; TO 15;
620 END DEFine statprint
```

KEYWORD OF THE MONTH

The user interface is one of the most important sections in any system.

One method of obtaining information through the QL keyboard is by using the INPUT command. In its simplest form INPUT is a straightforward procedure but at its most complex it can become daunting. It does not help that the QL User Guide does not give a complete or accurate description of INPUT.

The INPUT command works only with windows which are declared as consoles rather than as screens. The default windows are all consoles. If input is directed mistakenly to a screen rather than a console the rather unhelpful error message *bad parameter* is displayed.

Method

INPUT is related distantly to LET and READ in that it is a method of assigning a value to a variable. The basic command is INPUT followed by a variable name — see line 100. INPUT works with any variable type but it cannot assign a value to an entire array; each array element must be assigned individually.

It is recognised as good practice to precede an input with a prompt informing the user about what information is required. It is such a frequent requirement that, rather than preceding every INPUT command with a PRINT statement, a prompting string can be included in the INPUT command. The elements of an INPUT command can be separated by any of the normal print separators and can include the TO keyword.

Format

The format for an INPUT command with a prompt is shown at line 200. It is possible to concentrate a number of strings and variables to form a prompt by using ampersand symbols, as demonstrated by line 300. If the prompt is a single variable it must be enclosed in brackets, as in line 400.

As well as allowing for multiple prompts, INPUT can assign values to more than one variable. That is achieved by including a series of variable names, each separated by a print separator — see line 500.

If each part of a multiple input is to have its own prompt they, too, can be incorporated in the command, as demonstrated in line 600.

Using INPUT for numerical data can lead to programs crashing if the user enters alphabetical characters or presses ENTER before pressing a numerical key. One way to ensure that type of mistake is not fatal is to use the QL coercion facility to attach a zero to the front of a string input and then assign the result to a numerical variable. Line 700 gives an example of this error-trapping technique. The information might not be what the user intended but the program will keep running.

```
100 INPUT value
200 INPUT "Enter value "; value
300 x = 3: INPUT "No. " & x & " value"! value
400 e$ = "Enter": INPUT (e$); TO 12; value
500 INPUT "Enter " & x & " numbers"\ x, y, z
600 INPUT (e$) ! x, (e$) ! y, (e$) ! z
700 INPUT num$: value = 0 & num$
```

Listing 1.

```
100 INPUT value
200 INPUT "Enter value "; value
300 x = 3: INPUT "No. " & x & " value"! value
400 INPUT "Enter " & x & " numbers"\ x, y, z
500 INPUT num$: value = 0 & num$
```

Listing 2.

Software A

Make your QL

Bryan Davies concludes his series on developing a working business system using your QL

The time saving for me is often five to ten minutes per day and the file is only 162 bytes long. This file is loaded separately from the next ones because all the functions would not work if they were loaded together.

The next set of instructions loads and calls the code for QFlash including several SuperBasic extensions. The next instruction, "extensions" calls a procedure which loads and calls the code for more extensions. Several important programs can be run and I take the view that it is convenient to have all the extensions I need loaded at all times, allowing any of my most-used programs to be run without re-sorting to a "hot re-set" — i.e., pressing the switch buttons.

Note that each time you re-set through the keys, the whole boot file will be read in again, ensuring that the warm re-set and the extensions are always available. The <RESPR> command is used to reserve the amount of space needed by all the files to be loaded, four in this case. The four files have to be loaded to different points of this reserved space and you can view this process as stacking from the top downards. The first file, "files-code", is loaded to the top of the pile by the instruction <LBYTES flp1_files-_code, a+5354>.

Line 10 is a series of <POKE> instructions, the first of which will be of interest only to Ice mouse users. Running utility programs often leads to interaction with the main programs, or with each other. The mouse pointer can become very sluggish and, to revive it, it is necessary to increase its priority on the system job list.

These instructions do that, increasing the priority to 8, which is sufficient to give the maximum pointer speed, i.e., minimum required movement with my configuration. As I find the Ice default screen background of light green rather glaring, I also change this colour to a more restful pink with this line.

The last two POKEs are an attempt to speed typing and I find it only partially successful. Location 163890 contains the setting which determines the delay in repetition of characters written to the screen; when you hold down a key there is a noticeable lag between appearance of the first and second characters on the screen, and reducing the value from the default 30 will decrease this delay.

If you go too far, you will be unable to type just single characters. Location 163982 contains the value of the rate at which characters are repeated on the screen; the default is 2, so you cannot go far. My reason for changing these parameters was to reduce the appalling delay when the left cursor key is pressed in Quill; when making corrections, I tend to use 'left word delete' several times to return to an error, as this seems faster than pressing the left cursor key to get to the character.

Unfortunately, the Quill cursor soon reverts to its normal self and I have not yet added the acquired SB routine to keep resetting these two POKEs — that is one for you to try. Note that speeding cursor action too much can affect other operations adversely; you may find the cursor skipping instances when using Replace, "move, word, left", and so on.

Refer to picture one in conjunction with the next paragraph. "QL:menu:update" are three procedures which produce screens which require your input. "QL" draws a message and picture on the left side of the screen. "Menu" is the heart of the boot, from a usage point of view. It lists the available program or program-switching options and gives numbers from which to choose.

Before making this choice, the current date/time in the QL are presented; a simple "y" or "n" answer is required — no Enter needed. As opposed to the method used with some commercial software of entering values through the cursor keys, you type the required figures and Enter — a much faster method.

To read about what products are available, and what people think of them, you have no decision to make — take *QL World* regularly and join Quanta, the QL users' group — see advertisement at back of *QL World.* They are the two consistent sources of useful information on the QL and its associated array of suppliers. If you do not find answers to your questions there, you may still make contact with a few QL "authorities" through reading the articles and letters. The QL fraternity is very helpful, to the detriment of telephone bills in most cases.

Disc care

Errors can occur with discs but by no means as frequently as with cartridges. In more than 5,500 hours of usage, I have yet to detect any error with my 3½in. Mitsubishi one-third-height drives but I can almost guarantee to hit some snag each time I revert to Microdrives. To ensure this kind of disc performance, however, it is important to avoid the drives and discs becoming dirty and to be choosy when buying discs.

Use a disc cleaning kit — Inmac — at least once a month, vacuum the

Applications work for you

system area frequently — a car vacuum is useful — and buy either good branded discs — e.g., 3M, Fuji — or ones known to be from the same makers. On the latter point, I have used blue discs which were sold as being made by Fuji, although marked only Made in Japan, and had no difficulty with them.

Noise from discs may be just a feature of the particular manufacturing process; I am told that Japanese discs have a coating which makes them noisier than U.S. ones but that does not affect the performance. One well-known figure in the QL world told me of spending thousands of pounds on replacement discs after very bad experience with sub-standard ones on office computer systems.

Corruption

Corruption is a word which is not so much used these days, being mainly a feature of the bad old days of poor Microdrives and cartridges, and the tape-resident versions of the Psion programs. You do not remember Version 1.00? It is better that I do not dwell on it, but do not think you have the ultimate if your version number is 2.00. If you are at that level, obtain version 2.35, because there is a difference in the memory department which prevents switching programs working to best advantage with 2.00.

The best method of approach to errors produced on cartridges is to use discs instead; that may sound facetious but the cost of a disc system may well be less than that of your lost time, or revenue, after losing cartridge files.

If money prevents this approach, try and work in RAM rather than accessing the Microdrives all the time. This necessitates buying a RAM-disc program, often provided as part of an interface. Read the reviews, because such programs vary considerably in speed; the fastest seems to be *Qflash*. It is different from the usual RAM-disc programs and allows better utilisation of memory. The switching program *Q_Switch* also improves Microdrive saving times dramatically. On earlier QLs, increase the number of sectors available by removing the drive rollers, then cleaning and re-fitting them the other way up, leaving 0.25mm. clearance from the plastic collars. Clean the read/write heads also.

Clean your mouse every so often. The internal pick-up rollers collect a fair amount of dirt in a few months. If pointer behaviour is rather ragged, the light emitting/sensing mechanism in the mouse may be faulty or the connection of the mouse to the QL may be bad.

When your work outstrips the capabilities of the Psion programs there are some other possibilities. *The Editor* program was designed primarily as a tool for programmers rather than for Quill users but it has many features which one might like to see provided in Quill. Some document types are created better with Editor than with Quill; or utilise the functions which each program handles best to produce single documents with the two.

Editor vs Quill

Files can be swapped between them by using the Quill Import command and adding the extension _exp to files saved from Editor. Import is not the best of Quill routines; importing by line loses you the automatic formatting. Import by paragraph, then re-set tabs and margins. Text can be formatted in side-by-side columns with Editor; type the columns one below the other, make all necessary corrections, then use a suitable repeat instruction to call the lower paragraphs line-by-line.

Cursor speed is much faster in Editor than in Quill; making Copy and Erase operations is faster. Where little use is made of special codes for calling printer functions, Editor may be superior for all aspects of text production. About 70 pages need to be read before you can appreciate the range of commands provided. It is a Turbo-Supercharged program; if it stops when manipulating text and gives the message "Supercharged Basic stopped at line 0", it can be corrected using the file dataspace_task from the Supercharge program.

An "out of memory" message on its own refers to the allocation you give when the program is started. Error messages with the Turbo version of Editor should be mentioned to Digital Precision.

Runtime archive

There is also an alternative to Archive but it is a derivative of that program rather than a competitor to it. *Run-time Archive* (Archrtm) is a stripped-down version of Archive, retaining just the functions necessary for running a program. It is about 15K smaller than Archive and is generally more suitable for stand-alone programs; the Eidersoft *Impacct* accounts package and the Quanta library guide, both use it. — You cannot use Archive to edit_pro files for use with Archrtm; you have to use another version of Archive, Arch_dev. There were file corruption problems with Version 2.36 of

Software Applications

Continued from over page

Archrtm/Arch_dev but the current 2.38 seems satisfactory. Increasing sizes of _dbf files can sometimes be dealt with by using Backup; I have had a file drop by 70K this way and not be corrupted. If the Locate function is used, Order the records when you Backup.

Those who have managed to write programs in SuperBasic may be ready to make their masterpieces run more efficiently and one way is to compile them. *Supercharge* is a compiled SuperBasic program — i.e., Supercharge compiled itself — and is from the same stable as Editor, which makes it no surprise that the accompanying booklet runs to about 100 pages — and you need to read them.

The first likely snag with Supercharge is that it will refuse to compile the programs you feed to it. The QL will accept and run code which makes Supercharge stop and produce error messages. You have to correct all errors in the original program before compilation will occur.

Compiling

Correcting flagged errors does not guarantee that the compiled program will run as the SuperBasic original did; be prepared to spend time re-writing to get the desired result. *QL Liberator* is less choosy about the code presented to it and may be more suitable for some users. Both programs are expensive by QL standards but much more than the usual amount of programming effort must have gone into them.

If you are serious about compilation, there are other routes to circumvent the "bad code" problem; buy either *Better Basic,* which scans your program and reports errors for correction before compilation is attempted, or *Turbo Supercharge,* which effectively corrects bad coding and continues with the compilation. A compiled program will run faster but it may take more space. This is more apparent with small programs and will not be very significant if the programs originally needed 100K.

It is pointless buying all the ingredients for a smart system and not integrating them into an efficient package. You have to do that yourself, because nobody offers a full system package. You may be 10 minutes at the keyboard before you can start the work for which you are paid. The QL can get on with the routines needed to load and run everything while you spend those minutes more profitably.

Boot file

A multi-purpose boot is required and it is not too difficult to write. When the system is switched on and F1/F2 pressed, the basic QL looks automatically for a boot file on the cartridge in mdv1; a system with disc interface may look to flp1. If Ice is fitted, hold down the ALT key until F1/F2 has been pressed, or the boot will be ignored.

The boot should contain all the instructions you want to give the QL concerning the programs you wish to run in the current work session. Programs such as Editor require Procedure Space to be reserved at start-up time for routines which are extensions to those built into the QL.

To be able to choose between such programs and the Psion quartet you have to load all the extensions first, regardless of whether or not they are used. The files may add to 5-10K and it is not worth wasting that space for occasional use of the programs but you may wish to run, say, Quill and Editor in parallel. Calling-in a SB switching routine after the boot will clear the boot program, freeing memory for the working programs. The instructions in a switch routine need be few, occupying no more than a few hundred bytes.

The nature of your switching program may be such that utility programs have to be run before or after it; the instructions for running Key Define, Icicle, Caps Clock and so on should be in the same SuperBasic routine as the switch program rather than in the boot. Read the switch program instructions a few times, because some really useful functions can be overlooked. There is no sense in leaving the QL "on autopilot" to the point it has loaded and started programs, then taking over from the keyboard, if you know what files you want loaded and where in them you want to be.

Multi-tasking

The switching program may be capable of loading the chosen files automatically and of sending the cursor to the point at which you want to be. With Q_Switch, and using the first slot in a routine, you can put in a line such as:

```
1000 S_1$=CHR$(236)&CHR$(240)&
"lflp1_c_doc"&CHR&(10)&CHR&
(240)&'gb'
```

and have the prompts screen removed — pressing F2 — then a document named "c_doc" loaded from flp1, and the cursor go to the bottom of it when you key-in the appropriate code to call Quill.

Apart from switching on and selecting which daily routine you require you should be free to get on with something else for the few minutes it is likely to take for the QL to get ready for you to start real work.

Another point not to miss is that some switching programs allow you to load more than the obvious four Psion programs. Taskmaster and Q_Switch allow eight or more programs to be tasked. I have had seven copies of Abacus working simultaneously. The limit is available memory.

Information

Disc cleaning kit
Inmac (U.K.) Ltd
16 Silver Road
London W12 7SG.
Tel. 01-740 9540

3½in. discs, Qflash
Eidersoft
The Office
Hall Farm
N. Ockendon
Upminster
Essex RM14 3QH.
Tel. 0708 851099.

3½in. discs, Q_Switch
Transform Ltd
24 West Oak
Beckenham
Kent BR3 2EZ.
Tel. 01-658 6350

SECTOR SOFTWARE

★ 0772 454328 ★

TOUCH TYPIST

Don't even think about buying a replacement keyboard until you know how to use the one you already have. Why type slowly when you can be typing at professional speeds letters, basic programs, data etc can all be entered in a fraction of the time now taken by learning to type correctly. Did you know that it is harder to type with two fingers than it is to type correctly. Touch typist is the fastest typing tutor available for the Sinclair QL. It will teach you to type at up to 211 wpm. It is 100% machine code and has a keyboard tutorial to show you the keyboard basics, 3 teaching modes, adjustable speed and accuracy targets, very fast interactive keyboard, your results can be displayed on a graph and be saved to drive for future additions, the full lesson editor will allow you to alter and customise any or all of the 200 lessons which can then be save to drive to create a library of custom lesson sets, also included is a reward option where if selected providing you meet the requirements you specify you will be given a 100% Machine Code arcade game as a reward for your progress Touch Typist will run from disk, microdrive or ramdisk and is supplied on microdrive for only £12.00.

THIS IS WHAT *QL WORLD* HAD TO SAY ABOUT THE PROGRAM

"Succeeding admirably as a serious course intended for beginners and experienced typists alike, Touch Typist is a well presented useful utility which includes the professional polish of good quality software"—*QL WORLD*, July 1986.

VARIOUS

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MIRACLE 512K EXPANDERAM WITH THROUGHPUT EXPANDS YOUR QL TO 640K £115.00
INTERNAL 640K MEMORY UPGRADE LEAVES YOUR EXPANSION PORT FREE £110.00
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MICROVITEC 1451DQ3 DEDICATED MONITOR (SUPERB GRAPHIC DISPLAY) £260.00

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ONCE USED MICRODRIVE CARTRIDGES. THESE CARTRIDGES HAVE BEEN USED TO RECORD A COMMERCIAL PROGRAM, AND THEN NEVER BEEN USED. THOUSANDS HAVE BEEN SOLD AS BLANK CARTRIDGES. THIS IS A LIMITED OFFER AS WE ARE SELLING THEM AS FAST AS WE CAN BUY THEM.

£1.00 EACH OR £45.00 FOR 50

SECTOR SOFTWARE, having bought the first two Z88's from Clive Sinclair would like to contact all users of this machine for our Z88 mailing list.

★ NEW ★

SPELL BOUND

REAL TIME spelling checker for Quill on the expanded Sinclair QL. Checks input **BY THE CHARACTER** against its 30,000+ word dictionary. **SWITCHABLE 5 MODES OF OPERATION** to suit a variety of typing styles with **DICTIONARY AVAILABLE AT ALL TIMES. DISPLAYS EXAMPLE WORDS ON REQUEST. NO DISCERNABLE REDUCTION TO QUILLS SPEED OF OPERATION. DICTIONARY EXPANDABLE TO MEMORY/MEDIA LIMITS.**

AVAILABLE ON DISC OR MICRODRIVE AT ONLY £29.95.

QL SPARE PARTS

SERVICE MANUAL

THIS IS THE MOST UP-TO-DATE BOOK FOR REPAIRING THE QL. IT CONTAINS ALL CIRCUIT DIAGRAMS, FAULTFINDING CHARTS AND OSCILLOSCOPE DISPLAYS TO ENABLE YOU TO REPAIR YOUR OWN QL OR UNDERSTAND HOW IT WORKS **£25.00**

QL TEST SOFTWARE + RS232 LOOPBACK LEAD TESTS ALL THE MAJOR FUNCTIONS OF THE COMPUTER, EG SOUND, COLOUR, KEYS, RS232 MICRODRIVE ETC. AS USED BY REPAIR COMPANIES **£14.00**

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JS ROM SET £28.00
ZX8301 ULA £12.00
ZX8302 ULA £13.00
RAM 4164 150ns £5.00

SOFTWARE

TOUCH TYPIST	£12.00	TECHNIQL	£49.00
TASK MASTER	£25.00	MEDIA MANAGER	£40.00
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QFLASH RAMDISK + TOOLKIT ON MICRODRIVE	£19.00	FRONT PAGE	£23.00
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GARDNER	£20.00	HOME FINANCE	£20.00
TOOLKIT 2 (EPROM)	£34.00	REVERS!	£10.00
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PLEASE NOTE: ALL PRICES INCLUDE VAT & P/P.

David Batty

TASK MASTER

THE "ROLLS ROYCE" OF MULTI TASKING

NOT just another multi tasking program, but a complete front end memory management system for the expanded Sinclair QL.

ON SCREEN CALCULATOR with many features including delta percentage mark up/down POWERFUL FILE MAINTENANCE of discs/microdrives.

NOTEPAD with word wrap and "send note" feature.

SOFTWARE RESET scans for, and warns of any vulnerable open files at close-down.

SERIAL PRINT BUFFER, user configurable up to 32K.

DUPLICATE CODE SHARING allows you to load multiple copies of the same program without losing memory to additional code space. EG. 12 Abacus with 230K free.

COMMAND FILE MODULE easily creates files which will operate the machine in your absence. EG. could load Quill, fill in your address, type a standard letter AND print it. You will however have to post it yourself.

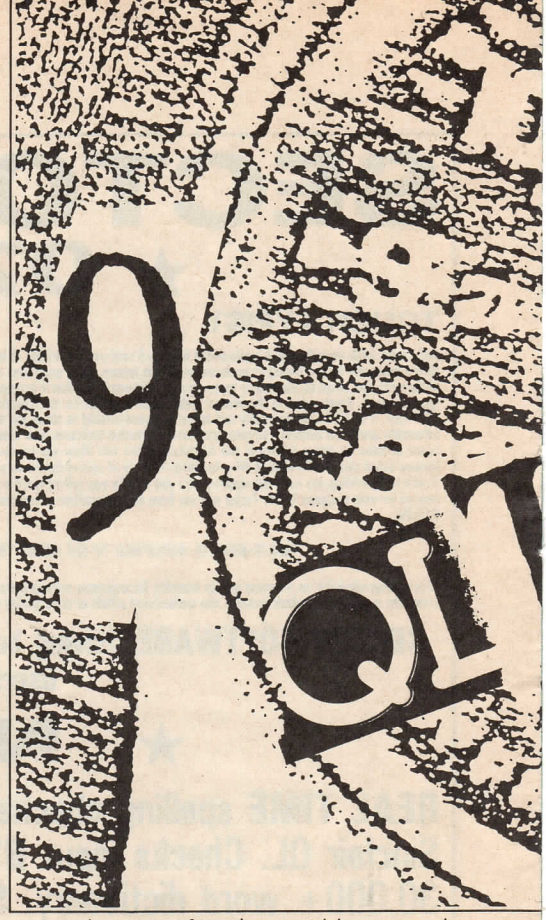
SOME are under the impression that Taskmaster consumes large tracts of memory.

FACT if you only wish to use the multi tasking module then that is the only one that you need to load, thus using only a small slice of memory.

OBVIOUSLY if you wish to use any or all of the other integrated modules then progressively more memory will be used. THE CHOICE IS ALWAYS YOURS. Although complex in its actions Taskmaster is so user friendly that it was described as "VIRTUALLY IDIOT PROOF" by a major software reviewer.

AVAILABLE ON DISC OR MICRODRIVE AND STILL ONLY £25.00.

QL EDUCATION...



Education is not all mathematics and English. During the next two months Leslie Fahidy will develop a program to teach children how to tell the time.

We will not be able to present all of it this month. The clock program is a considerable undertaking of some size and I estimate that it will take three months to complete it. In this instalment we discuss the general strategy and some outline algorithms, together with a detailed explanation of how the program appears to the user. You will have the complete listing in the July and August issues.

I admit that this plan leaves us somewhat short with respect to more detailed discussions, detailed algorithms and flowcharts. I have them all available and if sufficient interest is shown, we could extend the clock program by one more month and I could show all the details. Please let us know.

What is the program going to do? When teaching the time we must think of two aspects — we must teach the child how to read the clock and how to set it. We should let the child choose whether he wants to read it or set it — both methods teach how to tell the time. When the child is setting it, we must overcome the problem that there is no knob on the QL with which to set the hands, so we must improvise.

In our program we use the up and down arrow keys to advance and retard the hour hand and the minute hand. Further, it would take a long time to move either of the hands round the clock face — and it may sometimes be necessary to do that — so we shall use the shift and one of the arrow keys together to advance the hands faster.

Needless to say, when the child is setting the time the QL will generate a random time and the user is required to set the hands for that time. When the computer sets the time and the child is reading it, we will have to generate a random time and see if the learner can give the correct answer.

While on the subject of a correct answer we must mention that it is not easy to read the clock accurately when we are limited by the size of screen. We must allow a certain tolerance and still accept the answer as correct, particularly so far as the position of the hour hand is concerned. We could not really tell, except by calculation, where exactly the hour hand should be at, say, 11 minutes past nine.

Another important point is that when the user is reading the time, allowance must be made for a number of methods of input. There is more in question here than convenience. Telling the time is one of those fields in education where everybody will make an attempt. They will all teach the child how to tell the time. Unfortunately, they are likely to use different methods. So as not to confuse the learner further, we must make sure that all reasonable methods of entering the time are permitted.

The algorithm

The computer must realise that 'quarter to 4'. '3:45' or even '3.45' are all the same answer. The answer, or the setting of the clock must, of course, be evaluated and the verdict stated. If the answer was outside the permitted tolerances, or obviously incorrect we must also give the correct answer. A number of other points will arise in the course of our discussion but those are the most important and most obvious aspects.

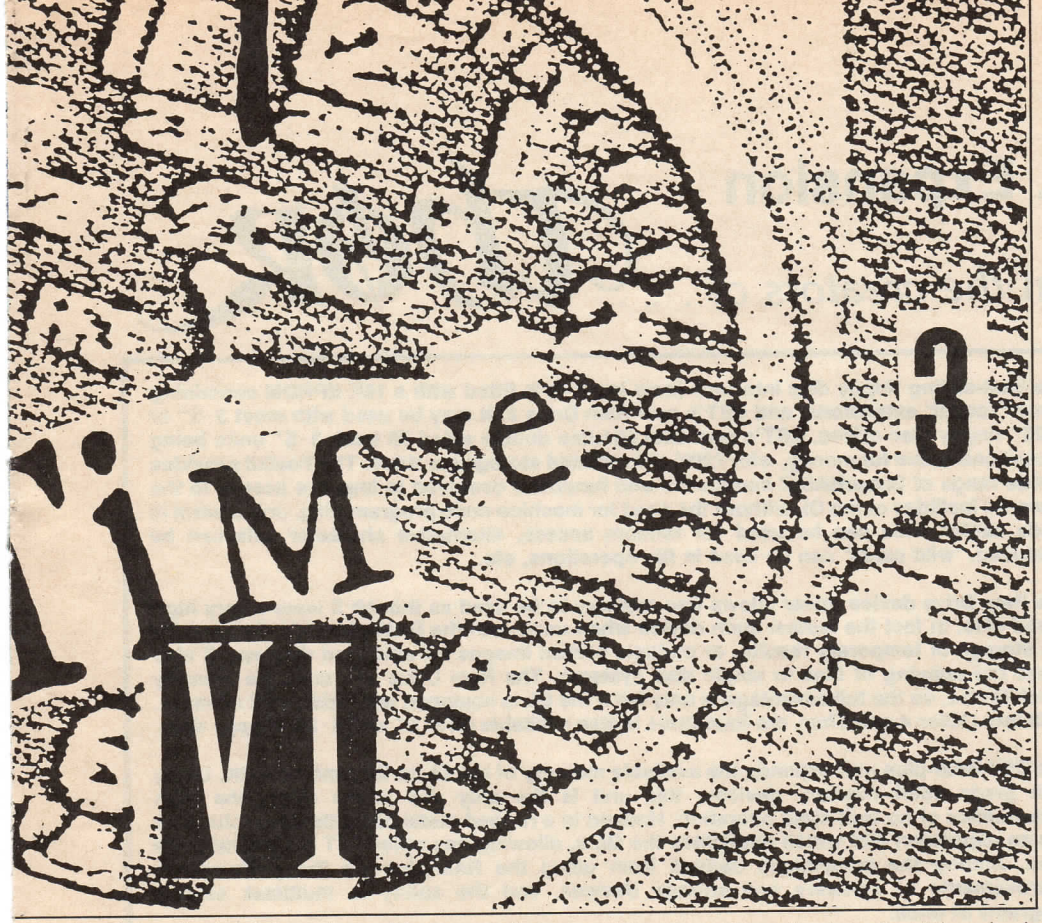
Another point I mention at this stage is that in drawing the clock face, positioning the numerals, drawing the lines representing the hands of the clock, we make use of turtle graphics, a variant of *Logo* — except for the fact that when using SuperBasic we do not have to load a separate language, as we have to do with Logo. The instructions of turtle graphics are part of our Basic vocabulary. I hope you will agree that it is a very powerful graphic language, yet simple to learn and use. We already know that we must start with a skeleton algorithm; let us proceed with that.

Outline algorithm

1) Use a procedure to draw the clock face.
2) Print the menu.
3) Invite user to input choice, whether to set it or read it.
4) If the choice is to read, carry-out procedure 'READ'.
5) If the choice is to set it, carry-out procedure 'SET'.
6) In either case, the response will be evaluated, the result stated and, if necessary, the correct answer will be displayed.

To draw the clock face we shall use turtle graphics and we have to carry-out three tasks. First, we must draw a circle, representing the clock. The circle command is available to do this but we must specify three parameters — the X and Y co-ordinates of the centre of the circle and its radius. Try to experiment with different sizes and positions; I found that a radius of 40 units, centred on the co-ordinates 50,50 gives the best compromise.

Second, we must put divisions on the perimeter of this circle, at one- and



five-minute intervals, with respect to the minute hand. It is not difficult to determine that we must turn the turtle by 360/12 = 30 degrees for the larger five-minute divisions; and by one-fifth of that amount, i.e., six degrees, for the one-minute divisions.

The third task is to print the numerals 1 to 12, and they must be in the proper positions. I found that I needed to experiment with this task. No matter how well you may have done your sums, the position of the numbers may not look as it should on the finished picture. Do not take the figures given in the listing as unalterable — try to experiment with them and and see if you can find a more pleasing arrangement for the numbers. Finally, when drawing the clock face, we must put in the hands, initially at the three o'clock position — why not?

Reading the clock

To read the clock, first we must clear up the clock face, because the previous display would have left the hands at that setting. The clearing is achieved by drawing a slightly smaller circle than the clock face, with the same centre, and using 'FILL' to paint it to the background colour. A certain amount of experiment is needed to make sure that we do not erase the numbers and the divisions as well.

Next we must establish a random time, both for the hours and the minutes. Needless to say, the hours must be between 1 and 12 and the minutes between 0 and 59. That is the time which the user will be asked to read.

We must draw the hands of the clock to represent this random time and invite the user to read it and to input a value of the time. I have already mentioned that we must exercise some care in choosing the different input formats which are allowed.

The program which will be presented allows for the following formats: a) the number of minutes past or to the hour — and the word 'minute' may be used or omitted, i.e., '13 past 8' or '13 minutes past 8' are equally acceptable; b) 'quarter' or 'half' past the hour and 'quarter' to the hour. When this format is used, it is necessary that either the word 'to' or 'past' is part of the input; c) number of hours separated from the number of minutes by: . , : or ; . i.e., 8.17 8,17 8:17 8;17 are equally acceptable; d) the exact hour format, such as : "9 o'clock", "3 o'clock", and so on.

The next task is to evaluate the input. Since the user is reading the time, there is no need to leave a margin of error; that will be applicable when setting the clock. Finally, we must state the result of the evaluation and, if necessary, display the correct time. Having done that, the user has a chance to read the clock once more, or exit from the program.

When the choice to set the clock is exercised, the user is presented with a clock face, showing 3 o'clock initially. As before, we must generate a random time, both hours and minutes, and ask the reader to set the clock to the required time. We will also give instructions. The message 'Adjust minute hand first' appears in the message window of the screen, together with the explanation that to advance the minute hand press 'up-arrow' and the 'down-arrow' to retard it.

Further, if either of the arrow keys is pressed together with 'shift' the advance or retard will be at five-minute intervals. The user is also told to type 'f' or 'F' — for finished — when the adjustment of the minute hand is complete.

Setting the time

From a programming point of view, each pressing of one of the arrow keys is followed by clearing the screen, as explained earlier, to erase the previous setting. Because of the speed of SuperBasic, this process is so fast that, if it was any faster, it would look unnatural.

When the setting of the minute hand is complete, the user is asked to set the hour hand. The process is the same, up- and down-arrow for advancing and retarding; the use of the shift key will advance or retard by one hour, otherwise a small fraction of an hour for each keypress. The end of the adjustment is again signalled by the user typing 'f' or 'F'.

The evaluation of the response is slightly different from that in the previous case. We must allow for a small margin of error in adjusting the hour hand. A similar allowance is not needed for the minute hand; after all, the position of each of the minutes is indicated clearly by a line, while the position of the hour hand must be an educated guess.

Correct setting

In spite of this, if the response is inaccurate by two minutes only, the user is told that there is a slight error in the number of minutes, rather than the statement that the answer is incorrect. If the answer was not correct, the correct setting will be shown.

As before, the user is again given the chance either to continue with another setting of the clock or to break out from the program.

Listings this month are conspicuous by their absence but I have them available and the program is working well. Please continue sending your comments. It is worth stating preferences since educational programs can be written in a large number of areas.

CST QL Expansion

from the creators of . . . Thor

QDISC
new eprom 1.19

The best-selling floppy disc interface (now issue 4) is fitted with a 16K EPROM containing many 'Toolkit' extensions, and CST's new Ram Drive 2. It may be used with most 3·5″ or 5·25″ floppy disc drives, CST's own twin slimline double sided 80 track 3·5″ units being exceptional value for money, with 720K of formatted storage per drive. The Toolkit provides a wide range of SuperBASIC commands and functions designed to improve access to the powerful facilities of the QL without the need for machine-code programming. Job control is made easier, files can be used for random access, alternative character sets can be produced, 'wild cards' can be used in file operations, etc.

Ram Drive
the fastest ever!

The Ram Drive device driver allows free memory to be used as though it were a very high speed disc, in fact the fastest such device when used with the RAM-plus. Ideally used for the storage of temporary results, or multiple screen images for animated displays, it also eases the copying of files in single disc systems. The Ram Drive can only use memory which is free, so the full advantage is only felt if the QL is equipped with additional memory. Built into QDisc 4 and Thor, the Ram Drive is also available on 3·5″ and 5·25″ floppy disc.

RAM plus

The CST RAM-plus unit expands the available memory of the QL to the limit of 640K. Using high grade 256K memory devices, this unit is the only one which offers the high performance of no wait-state operation. Housed in a rugged metal case, the RAM-plus unit has an expansion slot which duplicates the QL's, allowing any other CST peripheral to be used. Among the advantages derived from using the RAM-plus are the performance improvements of software and storage devices, and the ability to multitask several programs at once.

SCSI

CST's Interface for Rodime compatable Winchesters handles up to 8 SCSI devices and is complete with floppy disc interface. Using enhanced QDISC software, it supports heirarchical directories, easing file management; with well over 1000 files being possible, this is absolutely essential. A Data Management Utility is provided which speeds up backups by only copying recently modified files.

Q-488

The Q-488 provides comprehensive yet simple access to the IEEE 488 Instrument Bus for the Thor and QL. Developed with IEEE specialists Procyon Research Ltd, the Q-488 interfaces to equipment directly from SuperBASIC and other languages and provides commands for low level bus control and even built-in bus analysis.

Thor

The CST Thor is the ultimate development of the QL. Available in single and dual floppy and 20M SCSI Winchester models each with 640K RAM, parallel printer and mouse ports, battery-backed clock and separate 84 key PC-AT style keyboard, it is built into an attractive metal case with internal power supply and expansion slot for peripherals. Supplied with many unique extensions to QDOS including multitasking at a single key-stroke, enhanced screen windowing and making full use of all the keys on the full-travel keyboard, the Thor is supplied with a specially commissioned version of the Psion Xchange software suite, and a comprehensive manual. Contact CST or your local distributor for details.

CST

Cambridge Systems Technology
24 Green Street, Stevenage, Herts SG1 3DS
Telephone: Stevenage (0438) 352150

Please supply:–	UK inc VAT		Overseas	
Qdisc Interface 4 (3.5″ util. disc)	£79.95	☐	£72.70	☐
Qdisc Interface 4 (5.25″ util. disc)	£79.95	☐	£72.70	☐
QEP-III Eprom programmer (QL/THOR)	£129.95	☐	£116.00	☐
RAM-plus 512K QL memory	£139.95	☐	£125.20	☐
CST Dual 3.5″ cased floppy discs	£219.95	☐	£200.40	☐
CST Q-488 GPIB instrument interface	£224.25	☐	£198.40	☐
CST QDISC SCSI interface	£230.00	☐	£203.40	☐
Qdisc 4 + dual 3.5″ drives	£275.00	☐	£249.40	☐
Qdisc 4, RAM-plus + dual 3.5″ discs	£405.00	☐	£363.60	☐
3.5″ Utility disc inc. Ram Drive 2	£10.00	☐	£10.00	☐
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Eprom V1.16 for issue 2/3 Qdisc	£15.00	☐	£15.00	☐
Eprom V1.19 for issue 4 QDisc	£15.00	☐	£15.00	☐
Thor 1F (Single floppy)	£688.85	☐	£650.00	☐
Thor FF (Dual floppy)	£803.85	☐	£750.00	☐
Thor WF (Winchester + floppy)	£1608.85	☐	£1450.00	☐
Thor 20 1F (Single floppy)*	£1177.60	☐	£1079.00	☐
Thor 20 FF (Dual floppy)*	£1292.60	☐	£1179.00	☐
Thor 20 WF (Winchester + floppy)*	£2097.60	☐	£1879.00	☐

Available as an upgrade for existing Thor owners.
For floating point option contact CST.

Export administration	£5.00	☐
Airmail outside Europe	£5.00	☐

*Introductory price if ordered before June 30, 1987.
Prices are inclusive of carriage
CST reserve the right to alter prices and specifications without prior notice

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CST Thor TIMES CST
No. 870503

Thor Computer System — 68020 Version Released

Last month Cambridge Systems Technology (CST) released their 68020 computer which is the newest member of their "Thor" family. CST have labelled this machine the "Thor 20 System" or the "Thor 21 System" the latter being the Floating Point option with the MC68881 Floating Point Coprocessor (FPC) for high level mathematical calculations.

Both the Thor 20 and Thor 21 Systems are based on the Motorola MC68020 32 bit processor and are available with a choice of two clock speeds: 12.0 MHz (standard) and 16.7 MHz (this compares with 7.5 MHz for the original 8 bit Thor).

Performance is now increased in two main areas (in addition to the clock speed). One is the MC68020's enhanced architecture which includes an on-chip instruction cache, a fast local memory which holds recently accessed instructions; the next time the instruction is executed (often soon afterwards) it does not need to be fetched from main memory, saving considerably on execution time; this increases performance typically by 3 times at 12 MHz. The other main improvement is the FPC which increases the performance of FP operations up to 100 times. The floating point utilities have been rewritten to make use of the FPC, giving a dramatic performance improvement in Superbasic programs, screen graphics and other software using the utility vectors. Support software for other languages will be available.

The Thor 20 System comes complete with the award winning Psion Xchange software suite as supplied with the original Thor System — this alone being worth nearly £500. This user friendly suite allows you to design complex 3D graphs as well as having word processing, spreadsheet and database facilities. Also included in the package is an improved version of the ICE computer front end which has many extremely useful features including extended windowing capabilities.

The Thor 20 and 21 Systems are supplied with complete supporting documentation including Motorola's definitive User Manuals for the MC68020 and MC68881. Also provided is a suite of development software comprising an extended Macro Assembler by Talent Computer Systems which supports the full MC68020 and MC68881 instruction sets, and a Linker by GST.

Introductory prices for the standard version (12.0 MHz) range from £1177.60 (inc VAT) for the Single Floppy Thor 20 to £2097.60 (inc VAT) for the Winchester and Floppy Thor 20 System. This offer is valid for orders placed with CST on or before 30th June 1987. For a complete price list please contact Marie Shortland at CST.

URGENT URGENT URGENT URGENT

Thor 20 Final Offer

The special low-price introductory offer announced last month by CST for their newly released Thor 20 range, closes on 30th June 1987. This means that this month will be the last chance to purchase a Thor 20 or Thor 21 at the special offer price. According to CST, the aim is to make the product available to those who might not otherwise be able to stretch to the retail price of this exciting new product. After June, which is when the offer closes, the price will rise to cover development costs which of course can be quite considerable with any new product. For further details contact CST.

Protection Software

Software houses can now obtain, directly from CST, a new software package which forms the basis of a reliable protection method for greater software security. Unlike most other protection systems, this one is convenient and easy to use. Software houses requiring further information should contact CST on (0438) 352150.

Thor 20 Computer Range
Thor 20 Computer Range
Thor 20 Computer Range

68020

Three times faster.

QEP III Price Change

Last month also saw the introduction of a new price for the CST QEP-III Eprom Programmer for the QL and Thor.

The QEP-III is now available within the UK at £129.95 inc VAT or £113.00 plus £5.00 export for overseas destinations.

SOFTWARE FILE

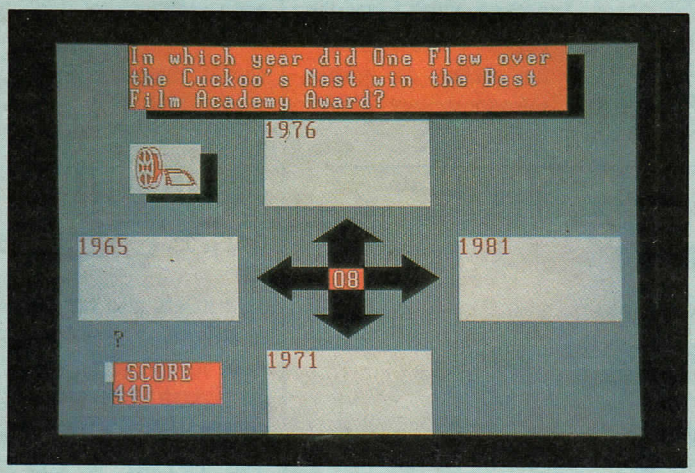
Ron Massey has fun with three new games, an adventure, a reflex snapping arcade offering and a mind taxing question and answer quiz.

Oxford Trivia

Price: £17.95
Source: Talent Computer Systems, Curran Building, 101 St. James Street, Glasgow G4 0NS.
Tel: 041 552 2128

Gaining continually in popularity, trivia games represent a good proportion of all current games sales, whatever form they may take. The long-awaited Talent *Oxford Trivia,* a computerised question-and-answer system, has finally arrived and has well been worth the wait.

Supplied with an initial quiz module of four categories of questions and answers, Trivia provides hours of nerve-stretching fun for the entire family. In common with most of the trivia games, Oxford Trivia data includes categories of questions and answers in



an expandable modular system, with the program module providing the means for unsqueezing the compressed files, selecting questions randomly and keeping track of the betting and scores.

Starting-up, the main program looks at the file module in mdv2_ to see which categories are available. Once the stylised directory and high score table is displayed, you press <SPACE> to go to the selection menu. A category is selected by moving a pointing-finger icon-cursor through the text menu with the up/down cursor keys. Selection of a particular category is made with the left/right cursor keys.

Players are given one life, 100 points and a chance to get three of the questions wrong as their initial stake. The game halts when any one of the stakes is lost.

Questions appear in a box at the top of the screen. Players are given a time limit in which to wager a percentage, wether 10, 25, 50 or 100 percent of their current score that their answer is correct. If the time limit is exceeded, the QL makes a default wager of 50 percent.

Once a wager is made, four boxes, each containing a possible answer, slide towards the centre of the screen and selection of one is made using the cursor keys. Whether or not a correct answer has been made is indicated in a central window, the score is incremented and the next question appears. Increasing immeasurably the tension of the game, the time allowance for wagering and answering each successive question is decreased.

I hope the sales for Trivia well exceed expectations because, depending on the sales of the initial games set, Talent plans to expand Oxford Trivia to an intended total of 16 categories, made up of 16,000 questions and covering a spectrum of interests.

Talent has done a marvellous job of program presentation. The Trivia graphics are exceptionally good and are used effectively throughout. Both icons and text have been used to represent available Q&A files for selection and interaction with the game. Oxford Trivia is, without reservation, highly-recommended.

Return to Eden

Price: £19.95
Source: T. K. Computerware, Stone Street, North Stamford, Ashford, Kent. Tel: 0303 812801

By sheer size the Hallmark graphic text game *Return to Eden* is monumental by any standards and is played across three very full 3½in discs. When certain locations are reached you are asked if you want to continue in the intended direction. If the response is yes, you are asked to change discs and re-boot the new disc to continue.

Nominally a role-playing game, you have the option of leaving your character – Tana, Otaga or Sador – in a manner of disembodiment, at its current location, to move independently other characters elsewhere or to collect them at the same place, somewhat in the manner of pieces on a game board.

If your current character is unfortunate enough to be killed you can switch to one of the remaining characters to continue play, giving you effectively three lives but from slightly different perspectives, inventories and attributes.

Game play occurs in real-time; clouds move lazily across the skyline and, at nightfall, the sky becomes dark. During the small hours of the morning, it becomes very dark and you have to wait until dawn before pursuing your quests.

Some commands, such as obtaining a list of your current inventory on entering a direction of movement – of which there are 10, – N, S, E, W, SW, SE, NE, NW, U and D, – may be input with single letters. You also have the option of entering typed-in verbal interaction with other characters present.

If you are unable to find suitable response at any stage of play, a range of help facilities is available during the adventure. Pressing <F1> provides an occasionally useful but mysterious prompt but not always.

Pressing <F2> provides a page of information about the game. Required access and control keys are listed, as is the range of verbs used by the game.

If you want or need to change to another character, pressing <F3> will provide access to the role-changing option. You are then required to press "1", "2" or "3", depending on the next role you would like to take.

<F4> provides a map of the isle of Eden; <F5> re-draws the text, command and status windows; that is very useful if you have been doing a good deal of searching. The game, also has an extensive Anglo-Saxon vocabulary.

The main part of the media space is taken by the screen. Since they do not produce a coherent image when loaded with the *lbytes* command, I can only assume that compression techniques were involved during the production of the set.

By typing-in "DESK" during play you are offered a comprehensive range of options for modifying the presentation of the game to your personal taste. Ink and paper may be modified for the status, text and/or command windows; Eden may be played with or without graphics; inventories of each of the three characters can be displayed, in case you forget what each character is carrying. New designs can be saved or loaded from this menu.

There were a few minor irritations while playing. To provide a better user interaction, I would have liked the map to indicate the current position or either the current character or of each player.

A few of the responses indicated its non-English origin. Two prompts of this type, in particular, stand out in my mind: "Got a friendly laughing on his face.", and "You have seldom ideas". To be fair, such prompts were rare and amusing in their own right.

Producing text games usually presents difficulties at two independent levels — ensuring that both the logic for game flow and the spelling are correct. The Return to Eden supplied for review was a pre-release version and the spelling of a number of prompts had a number of mistakes.

When viewed for the first time, that is usually amusing but can quickly become irritating after seeing them several times. Text games, and particularly ones of this size, often suffer from this problem, a kind typist's fatigue.

Be that as it may, warts and all, Return to Eden is great fun and highly addictive. There are many locations, plenty of scenery and variety and the interaction of player and response is good. Considering the number of discs on which it is supplied, Return to Eden also represents very good value.

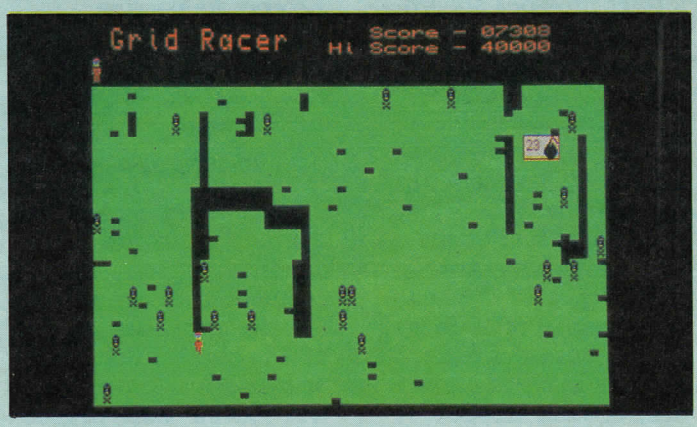
Grid Racer

Product: Grid Racer (from Super Arcadia)
Price £2.00
Source: Digital Precision, 222 The Avenue, London.
Tel: 01 527 5493

Another arcade-type game, the second offering from the Digital Precision *Super Arcadia* duet, *Grid Racer* is what I can only describe as a genuine fun game.

Full of action and symbology, with a distinctive James Bond-ish flavour, a complete range of skills is needed - fast reflexes, careful strategy and sound judgment of spatial relations.

Movement round the *Grid Racer* screen is done with a single cursor-controlled sprite and must avoid bombs while dodging round other obstacles. As you move round the screen, a trail is left behind you. Although you are not allowed to back-track on yourself directly, a number of screen positions will allow you to shift the relative positions of everything on the row of the sprite position to the left or right.



Your goal, a ubiquitous mobile box, containing the game's time clock, continually ticking away your current life, must be entered from a direct route. Points are gained when your character reaches the primary goal - kind of home base - but bonus points are available by collecting various artifacts such as daggers, sticks of dynamite and other pleasantries.

At random intervals, every 600 points or so, your are given a separate screen on which you can either win a large bonus or, failing to hit your target, gain an extra life. As the game progresses through its various levels, the number of bombs and obstructions increases and, after winning 8,000 points, a further hazard, which looks very much like a large red boot, makes its appearance.

When that happens, you must avoid contact with the boot and can still shift sideways provided you are on a row with the bombs and then only if the boot is not on the same row with you.

A handy feature is that it includes a PAUSE option, allowing you to catch your breath. That is just as well, because dithering during play is not allowed. Failure to press a key, except during pauses, will incur time penalties.

UTILITY FILE

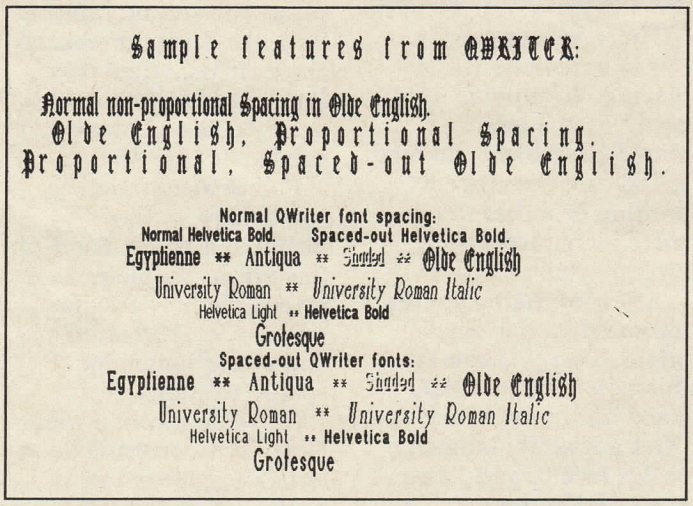
Ron Massey checks out four printing packages which provide a range of different typefaces.

Being able to utilise a range of font styles is a major concern to anyone who uses a QL to produce hard copy, whether for personal or a host of business-related correspondence or for producing copy intended for mass reproduction. Relying solely on the range of character sets ordinarily available to printers, of any kind, often leaves much to be desired.

While printers are not the main topic of this month's Utility File, it is worth mentioning some of the options available to anyone who may be considering buying a printer. The main consideration for most users is whether to opt for a daisywheel or a dot matrix printer. The former provides superb carbon ribbon quality, rivalled only by laser printers, is moderately-priced and is capable of producing camera-ready documents for mass-copy applications.

Principal limitations are that daisywheels are relatively slow — usually in the region of 10 to 20 cps; do not cater for changes in typestyle or size, without labour-intensive exchange of daisywheels; are relatively fixed function; and do not support graphic dumps.

Dot matrix printers, on the other hand, are inherently more flexible and offer a number of built-in printing modes which cater for draught copies at up to 200 cps, with near letter quality available at printing speeds usually more than double that of the daisywheel and incorporate varying degrees of programmability, much of which is often graphics-orientated.



Middle-priced

Many middle-priced dot matrix printers are nominally Epson-compatible. If one of these is purchased, the user is assured that most printer driver programs will provide some degree of acceptable copy. Printers at variance with the mainstream of design with regard to control codes, in fact, cause plenty of problems.

Taking advantage of the fact that most dot matrix printers are programmable in their own right — and deserve a detailed study if their full potential is to be realised — four program systems are now available for the QL, greatly extending this untapped potential.

QWriter is the first of the font utilities, from the Hallmark collection of QL programs. It includes a set of nine fonts, with a size range of 3mm. to 7mm. Changes of typeface may be made from SuperBasic or from within text-orientated programs such as *The Editor*.

Supplied in two versions, unexpanded QLs may have up to two fonts loaded at any time; expanded machines may use the version of the program module which supports up to 32 fonts in memory, each being called by its associated font number.

Printer commands are initialised with the *QWriter* port emulation with the command NLQ_USE *device,* either ser or par. Font changes can occur by using either PRINT # 3,chr$ (2);chr$(fontnumber); 'string$' command or, if the toolkit command BPUT is available, by BPUT # 3,2,*fontnumber,(+ any optional additional control code numbers)* — assuming #3 is the channel assigned to the printer. One point worth noting is that all font changes must be prefaced by the number "2" and either method may be used from a SuperBasic program.

Control codes

A comprehensive range of additional control codes is available for optional double-strike, print density, tabulation, form feed, double width of characters, extension of row spacing and proportional character spacing.

The QWriter definition of unproportional spacing is that the width of each character is determined by the widest character in any given font. Subsequent font changes cancel previously-selected unproportional spacing.

Line spacing can be regulated by mixing proportional, unproportional, normal, space out and single- or double-width options. The latter option increases word lengths by approximately two-and-a-half times.

Control codes using BPUT in programs such as The Editor, where <CTRL><C> (=BPUT 3) is used, which would otherwise take you back to SuperBasic, can be inserted by using <SHIFT><CTRL><C> instead. The Editor character set will indicate an over-scored alphabetic equivalent of the

appropriate numeric value i.e., 1=A, 2=B, and so on.

First reviewed for Utility File in July, 1986, *Inkwell* is one of the least expensive of the custom font printing utilities and works with all Epson-compatible printers, producing graphics-originated characters. Making use of Quill_*lis* files or documents produced with an editor entails installing the appropriate control codes in a document, saving it as a file and printing it, using the Inkwell controller program.

Inkwell is supplied with eight 128-character fonts and a rather good font designer, in a 16×16 element grid, for extending the range of fonts. Provision is made, when using cut-sheet paper, for including control codes in a document which will pause the printer for a change of paper.

Icon range

In addition to the usual range of fonts, Inkwell, in common with font programs which include a designer utility, can also produce an almost unlimited range of icons or specialist symbols.

CuePrint is a printing system dedicated to the Canon PW1080A and Taxan/Kaga-related family of dot matrix printers. Taking advantage of the Canon facility for extending its font range by the addition of one of the optional font ROMs, wherein users can select any of four NLQ font ROMs — Orator, Italic, Courier or Gothic — for extending its NLQ printing range.

The principal disadvantage of the original Canon concept is that each change of font ROM requires that the top of the printer be removed to gain access to the motherboard. An element of risk was also present that damage to the PCB could occur when installing or removing a ROM.

CuePrint is supplied as a complete support system for the Canon dot matrix printer and comprises three modules — the printer driver, configuration system, controller and 15 fonts; a 64K RAM chip; and a printing toolkit.

Installing the RAM chip — replacing the font ROM function — requires a once-only access to the Canon motherboard and very detailed, illustrated, step-by-step instructions are included with the documentation for the installation.

Once the 2764 RAM chip is installed — with the chip's notch in the same orientation as the three ROM chips already on the board — one mandatory DIP switch change is made; number five on SW1, NLQ option availability, is set to "ON".

Optionally, number three of SW2, the selector for having the 3K buffer defined as either an input buffer or as a Programmable Character Generator may be set in either position.

Talent Sideways and the *Qats* sideways-printing utilities rely on having this buffer available as a PCG and will not work without it. For that reason if you are intending to utilise any of the sideways printing utilities, this DIP switch should be set to OFF.

Alternatively, if sideways printing is not required, having this switch set to ON will free the QL more quickly during a printing session.

A genuinely versatile system, the CuePrint driver may be used in either of two ways. If a selected font is copied to the printer port, either ser1 or par, using the *COPY_N* — without a file header — command, subsequent printing will occur in NLQ of the selected font.

If control codes are inserted in blocks of text produced by The Editor or Quill, each occurrence of the copyright symbol will download the following font number into the new Canon RAM and characters following the (C) symbol will occur in the new font. If two copyright symbols are used together, the following commands are ignored.

Another CuePrint strength is that the superb Maths symbol set contains 260 characters for printing virtually every combination of symbol used in mathematical notation.

Each of the fonts is about 5K in length. If frequent changes of typeface are made it is recommended that the required fonts are loaded into RAM disc, rather than perpetually accessing disc or Microdrive.

Font design

The design of new fonts is simple. Burridge recommends that one of the existing fonts is modified, rather than starting from scratch, to ensure that the font header information is available.

Individual characters may be positioned relative to the other characters in any given font and may, as is usually the case, include descenders. As each character is designed it may be tested on the printer prior to saving it to a file first.

The third part of the CuePrint system is a collection of toolkit routines and extensions related to graphics. Three procedures are available which can set window parameters to provide absolute pixel plotting, point plotting relative to the set window values, and drawing a line between two successive points of defined mark space ratio.

Five procedures are available for graphics printing for the Canon/Taxan-Kaga and include facilities for printing

Feature	QWriter	Inkwell	CuePrint	Tascopy
No. of fonts supplied	10	8	15	5
Non-English fonts supp.	No	No	Yes	No
Font designer	No	Yes	Yes	No
Designer grid	—	16×16	23×16	—
Descenders available	—	Yes	Yes	Yes
Character repositioning	—	No	Yes	No
Proportional spacing	Yes	Yes	Yes	No
Typefaces	Graphic	Graphic	Character	Graphic
Use of icons/symbols	No	Yes	Yes	No
Symbols supplied	None	None	260	None
Sub/superscript	No	No	Yes	No
Cond/enlarged	No	No	Yes	No
Available from Basic	Yes	No	Yes	No
Control program				
Device re-configurable	Yes	Yes	Yes	No
Presentation re-config.	N.A.	No	Yes	No
Page formatting	No	Yes	Yes	No
Printer control codes	Yes	Yes	Yes	Yes
Variable print density	Yes (4)	No	No (NLQ)	No
Translate characters	No	No	Yes	No
Variable line feed	No	Yes	Yes	No
Variable line width	Yes	Yes	Yes	No
Type of file required	text	_lis/text	_lis/text	_list/_tas
Right-hand justify (all fonts)	No	No	Yes	No
Disc/RAM disc compat.	Yes	Yes	Yes	No
Multi-tasking	Nominal	No	Yes	Yes
Special features				
Font changes per line	Any	Any	Any	1
Spacing characters	Yes	No	No	No
Inverse printing	No	No	No	Yes
Boxed characters	No	No	No	Yes
RAM transfer of fonts	—	—	Yes	—
Supplied with editor	No	No	No	Yes
Printer compatibility	Epson	Epson	Canon/Taxan	Epson

colour-to-grey-scale related dumps or a small limited colour-translation dump and for defining the printer device. A graphics dump may be made from either MODE 4 or MODE 8 and as either a positive or a negative — inverse — print.

Function keys

Additional routines include a procedure for programming the function keys — <41> to <F10> — and a timer with a range of 20 minutes and an accuracy of plus or minus 0.02 seconds. Three exponent extensions are also provided — a procedure for selecting either normal Qdos exponent handling or for providing an overflow trap; another procedure for setting overflow return value; the third, a function, sets the overflow flag.

Extensions for SuperBasic management are provided to obtain the length of the entire SuperBasic area (*LENBAS*), length of the program file only in its tokenised form (*LBASIC*) and free memory (*FREE*).

Another of the well-established font/printer controller utilities, *Tasprint* is supplied configured for the Epson FX80. Several printer options are available and can be menu-selected for installation. Where no direct printer equivalent is listed, a series of helpful screen prompts will assist in building a custom printer driver for most brands of dot matrix printer.

Exceptional in that Tasprint can be used not only with Quill *_lis* files or any text editor files, the system includes a simple screen editor program into which a document may be loaded — requiring a *_tas* identifier on the filename — and from which it can be printed. The only limitation of the Tasprint screen editor is that it will accommodate documents only of 320 lines or fewer.

The Tasprint system is supplied with and limited to Normal, Lectura Light, Median, Compacta, Data Run and Palace Script fonts, each printable in normal, inverse, boxed or underlined. Tasman recommends that no more than one change of font per line or the results could be unpredictable.

Once a document is completed in Quill, it is printed to a drive — which saves it as a *_lis* file — and loaded into the Tasprint editor for insertion of the control codes. When the appropriate control codes have been added, the document is printed.

One of the main problems many users have with printers is the design of a printer driver for their systems. If all printers used the same control codes there would be no difficulty. Since that is not the case, the main difficulty seems to be convincing computer users that they should experiment to see how their particular printer responds to control code permutations.

Compromises

Each of the programs reviewed had to include compromises in its design. Inkwell requires that you do not allow a document produced by Quill to perform a line wrap. Because Quill does not generate a line feed for a linewrap and Inkwell requires that this code is available, it is recommended that before the end of a line is reached you press <ENTER>.

Inkwell font sizes are roughly the same as normal expanded typefaces and include an option of equal or proportional spacing, the latter in either of two spacing gaps. Where high density of finished print is required, documents could possibly require photocopy reduction.

The sole limitation of CuePrint is that it is designed for the Canon PW1080A and other Taxan/Kaga-related printers because, in the author's view, it is the best graphics printer available. Having a Canon, I can only say that I can relate to that.

Of considerable importance to users having problems with setting-up printers for CuePrint, Burridge is offering a helpline for purchasers of this system, provided questions relate to this system and/or Canon printers. As CuePrint will not work on non-Canon-related printers, that is a fair enough restriction.

Large face

QWriter, with the exception of one of its fonts, produces fairly large typefaces. If used on its own for applications in which the final copy will be reduced or for notices and the like, this is acceptable. Where a mixture of type sizes is required, users could easily justify having both QWriter and CuePrint systems, as they complement each other.

QWriter will work only if no more than two jobs are currently running in the QL. I found this particular limitation irksome because it will not function with the many other jobs I normally run at any time, such as the menagery run with Taskmaster.

One way around this limitation is to produce documents as if they were to be printed normally and have Quill or Editor as the only other jobs when using QWriter.

Although the review version of QWriter did not include a font designer, I understand that the release version will include a utility for adding fonts to the QWriter collection.

QWriter
TK Computerware, Stone Street, North Stanford, Ashford, Kent CT25 6DF.
Tel: 0303 812801
£14.95

CuePrint
D. A. Burridge, 23 Cromwell Avenue, Hammersmith, London W6 9LA.
Tel: 01-748 3437
£37.95

Inkwell
Palintir Products, 60 St. Lukes Road, Bedminster, Bristol
£9.95

Tasprint
Tasman Software Ltd, Springfield House, Hyde Terrace, Leeds LS2 9LN.
£19.95

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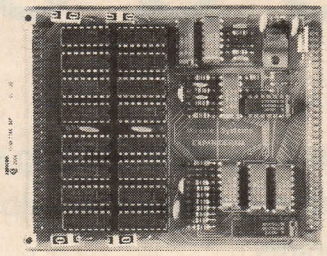
★ Autodial
★ 3 metre cable
★ Plugs into SER2
★ Includes Viewdata software
★ Includes 80 column software
★ Not BT approved

QL MODAPTOR £39

★ New printout software

★ Interfaces QL to standard modem
★ 300/300, 1200/75, 1200/1200
★ Autodials with DTR
★ Plugs into SER2
★ Terminated by 25 way D
★ Includes Viewdata software
★ Includes 80 column software

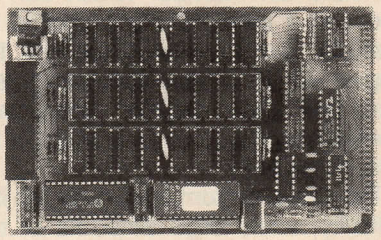
QL EXPANDERAM 512K £99



★ Increases QL memory to 640K
★ Through connector for i/f
★ Low power consumption
★ Can speed up some programs
★ Able to use larger Quill docs etc
★ Black cover included

QL TRUMP CARD £199

768K RAM + DISC I/F



★ Increases QL memory to 896K
★ Standard 3½ inch disc i/f
★ Screen Dump
★ RAM Disc
★ Printer Buffer
★ Memory Cut
★ Toolkit II
★ £50 Expanderam trade-in
★ FREE 'T' shirt

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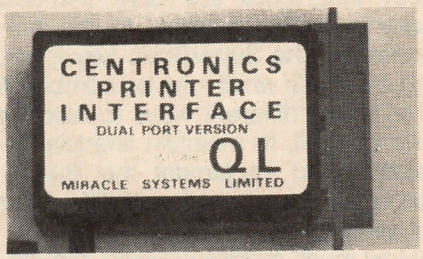

★ Plugs into SER1 or SER2
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★ Default baud rate 9600
★ 3 metre cable

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★ 4 QL's to 1 printer
★ 5 metre cable £7.50
★ 10 metre cable £12.50
★ 20 metre cable £19.50

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★ 3 metre cable

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How long is a string?

James Lucy looks at string storage and text compression, including a program to help solve those devilish crossword anagrams.

Judging by the endless variety of readers' programs appearing at the back of this magazine, it is possible to do almost anything with SuperBasic. The number of programs which theoretically could be written is large, or practically infinite when you bring in the numbers which play so important a part in the language. With that in mind, it is rather surprising to recall that there are only 140-odd building blocks available to the programmers, the SuperBasic keywords, and it is those which can be combined in so many different ways to teach a child to spell, to maintain financial records, or to implement the Runge-Kutta methods of solution of differential equations.

How much more surprising, though, to think of the enormous richness of the English language, from Shakespeare to the *Sun,* being built on only 26 characters and some punctuation marks. Manipulation of the basic characters of our language, using in some cases the other language shared by readers of this magazine, SuperBasic, is the subject of this article, and an anagram-solving program is given as an example.

Computers store everything in memory as numbers, and strings of characters are no exception. It follows that some arrangement must be made for encoding a letter into a number and like most small computers the QL uses the ASCII system. It utilises seven of the eight bits available in a byte to provide 128 numbers to which characters can be assigned. An upper-case 'A' is 65 in ASCII, for instance.

The QL goes on to use the highest of the eight bits for its purposes, the foreign and scientific symbols with codes of 128 upwards. ASCII is by no means the only system in use, EBCDIC is used in some larger computers; the hexadecimal numbering system could be used for strings which included only the letters A to F and there is even a base 36 numbering system used by airlines for the three-letter codes which indicate the intended destination of your suitcases. None of these other possibilities seem particularly promising for text, so we may as well start with ASCII.

String storage

The other element necessary in the storage of strings is some indication of length, so that the machine knows how many of the succeeding memory locations contain the ASCII codes of the characters of the string — at last an answer to the conundrum concerning the length of a piece of string.

In the QL, a memory word — two consecutive bytes — is used to store the length and precedes the string, so the single character string 'A' would appear in memory as three bytes, containing 0.1 and 65 respectively. Theoretically, string lengths of up to 65,536, the maximum number which can be stored in a memory word, should be possible, but for various reasons the longest string is two characters less than half that, 32,766 characters. Needless to say, it is long enough for most purposes.

The ASCII system begins to run into difficulty when large amounts of text need to be processed. If you need to send text by modem down an international telephone line, the byte-for-each-character approach can start to become expensive. If you are writing an adventure game you will wish to pack the maximum amount of text on to the cartridge, and the same applies to spelling checker and word game programs.

Compression

There are any number of methods of text compression and all have their strengths and weaknesses. Taking as an example the only spelling checker available for the QL. *QSpell,* it occupies about 64KB of memory and contains more than 25,000 words, so it does not take a genius to see that each word averages fewer than three bytes.

Because users expect their text to be checked reasonably quickly, the method of compression must allow fast access and must also allow additions to the dictionary — the latter requirement is not imposed on another good QL text manipulator, the game *Scrabble* by Leisure Genius. Those who know and like the board version of the game will not need reminding of some of the pre-requisites — a wide vocabulary, including special Scrabble words like Dzo, very quick access to that vocabulary, rapid matrix arithmetic and a sound grasp of strategy.

The 68008-brained Scrabble player has all those attributes except, fortunately for the ego of human opponents, the grasp of strategy — just watch it open those triple-word squares. Leisure Genius Scrabble packs about 20,000 words into much the same space as QSpell but uses a different method of compression, a kind of tree structure where one beginning of a word will be shared by a number of word-ends.

Huffman coding

There are numerous other methods of compression, both character- and word-based. If you needed to send messages via some expensive medium, such as a cellular telephone link, and were content to restrict your message vocabulary to 256 words, you could use one byte for each with a look-up table at each end of the comms link, reducing your telephone bill by 80 percent and, incidentally, providing short-term message security.

Using two bytes for each would give a 64K vocabulary, sufficient for anyone except a lexicographer. If you insist on a character-based compression, a method known as Huffman coding gives demonstrably the best size reduction for reasonable size files. It is next to useless for short files because information about how the text was compressed must be stored along with the compressed text.

Put simply, text is analysed to establish the frequency of occurrence of each character and then a coding scheme devised automatically to mini-

```
100 REMark Anagram Finder
110 REMark James Lucy 1987
120 MODE 4 : WINDOW 448,200,32,16 : OVER 0 : CSIZE 0,0
130 CLS : INPUT "Type the letters  ";an$
140 L=LEN(an$) : M=L
150 INPUT "Any letters known? (Y/N)";lk$
160 IF lk$=='Y'
170  CLS : PRINT 'Type the known letters in position'
180  CSIZE 3,1 : AT 2,0 : PRINT FILL$('_',L)
190  AT 2,0 : OVER 1 : INPUT k$ : OVER 0 : CSIZE 0,0
200  IF LEN(k$) < L : k$ = k$&FILL$(' ',L-LEN(k$))
210  FOR a=1 TO L
220   IF k$(a) = ' '
230    IF a=L : EXIT a : ELSE NEXT a
240   END IF
250   b = k$(a)INSTR an$
260   SELect ON b
270    =0 : PRINT 'Error' : STOP
280    =1 : an$=an$(2 TO M)
290    =M : an$=an$(1 TO (M-1))
300    =REMAINDER : an$=an$(1 TO (b-1))&an$((b+1) TO M)
310   END SELect
320   M=LEN(an$) : IF M=1 : PRINT 'Why ask?' : STOP
330  END FOR a
340 ELSE
350  k$=''
360 END IF
370 anag an$,''
380 :
390 DEFine PROCedure anag(w$,s$)
400 LOCal N,a : N=LEN(w$)
410 IF N>1
420  FOR a=1 TO N
430    IF a=N : anag w$(1 TO (a-1)),s$&w$(a) : EXIT a
440    anag w$(1 TO (a-1))&w$((a+1) TO N),s$&w$(a)
450  END FOR a
460 ELSE
470  reassemble k$, s$&w$
480 END IF
490 END DEFine anag
500 :
510 DEFine PROCedure reassemble(known$,ana$)
520 LOCal a,ac,finish$ : finish$=FILL$(' ',L)
530 ac=1
540 IF known$='': PRINT !ana$! : RETurn
550 FOR a=1 TO L
560  IF known$(a)=' '
570   finish$(a)=ana$(ac)
580   ac=ac+1
590  ELSE
600   finish$(a)=known$(a)
610  END IF
620 END FOR a
630 PRINT !finish$!
640 END DEFine reassemble
```

mise the length of the compressed file, using the minimum number of bits for each character. Since the encoding scheme will vary depending on the character content of the text, information about the coding used must be stored with the file to permit its subsequent interpretation.

Super fill

SuperBasic is well-endowed with string-handling facilities; as is well-known, strings are handled as one-dimensional character arrays and may be sliced using such forms as 'A$(n TO m)'. That approach is probably more versatile than the MID$, LEFT$ and so on of other machines but if you are keen on these commands you can define your functions to emulate them, using QL string slicing.

A less-used command is FILL$, which can be very useful in initialising long strings to a certain value or for padding a string to a required length. FILL$ is used in the latter role in the program shown in the panel.

Coercion, the automatic conversion between numeric and string data types, tends to blur the distinction between the two and can be a useful feature in certain circumstances. If you need extremely high-precision arithmetic it is possible to treat long numbers as strings and then to use string slicing and coercion to implement your arithmetic algorithms. The function INSTR, returning the position of a string inside another, is often overlooked, and once again is used in the program.

Addicts of cryptic crosswords will be only too familiar with anagrams. Usually, the letters of one or more of the words in a rather contrived sentence must be re-arranged to form the solution to the clue. Words which contain the letters s,t,l,n,r,a,e,i,o tend to have a number of anagram possibilities but rarely do you see such intriguing examples as the anagram pair 'excitation' and 'intoxicate'.

Computers can be used to help solve anagrams in one of two ways. The brute force method is to search a large database of words, checking to see if each contains the letters to be re-arranged, but things are more complicated if the solution contains more than one word. A simple search is possible on the QSpell spelling checker but it cannot cope with multi-word answers. The alternative method is to generate all possible combinations of the given letters and then to analyse the character sequences produced for 'wordness'.

Anagrams

The analysis can be carried-out in a number of ways and is an involved process; one possible method is described in the July, 1986 issue of *Byte* and revolves round measuring the frequency of each of the possible combinations of three letters in typical written English and then using them to calculate a probability that a character string output by the anagram generator is a word.

The program here uses a different analysis system — you. It displays all combinations and lets you choose but is easily adaptable to any filter system you might care to devise.

The problem of generating all permutations of an arbitrary number of letters is difficult. If you know someone who thinks he has programming sewn up, try it on him. The immediate reaction is to reach for nested FOR — END FOR loops, but how many? The answer lies in using recursion to decide and procedure 'anag' in the program is duly recursive. To avoid unnecessary complication it does not suppress duplicate permutations caused by duplicate letters; if you ask it for all permutations of 'AAA' it will suggest six.

The program is arranged more as a series of fitlers than as procedures. The lines up to procedure 'anag' accept input of the source letters, allowing the positions of any known letters to be stated, and 'anag' generates all possible combinations of the letters which remain, calling reas(semble) after each to print the result.

The printed word consists of the output from 'anag' placed among the known-position letters. It would obviously be straightforward to re-direct the output from reas to a file and then to use some kind of analysis on the file to print only the likely words. To keep the program reasonably short and easy to type-in, error-trapping and input validation have not been included.

To use the program, first type all the letters to be re-organised in reply to the 'Type the letters' prompt. If you know the position of any letters, answer 'Y' to the 'Letters known' prompt. The appropriate number of dashes will appear; type any letters known in their positions, separated by spaces where necessary, and press 'Enter'. All combinations matching the template you have specified will be displayed. Of course, if you have a hunch about any letter, or for instance you suspect the word ends in 'ing', you can put that in, too, and see what is produced. Although the program inevitably will produce the correct answer eventually, the chances are that simple observation of the suggestions produced will suggest the answer long before it arrives, such is the power of the human brain.

QL CONN

Colin Opie finishes his discussion of directory device drivers and looks at the accessing of Qdos TRAP and utility calls.

Offset (A1)	Name	Use
$00		Reserved for use by QDOS
$10	*FS_DRIVR	Ptr to access layer link for driver
$14	*FS_DRIVN	Drive number
$15		Reserved (byte)
$16	FS_MNAME	Medium name (word + 10 bytes)
$22	*FS_FILES	Number of files open

Figure 1.

```
moveq    #0,d0              ;Get physical def. from ID
move.b   FS_DRIVE(a0),d0
lsl.b    #2,d0
lea      SV_FSDEF(a6),a2
move.1   0(a2,d0.w),a2
;
subq.b   #1,FS_FILES(a2)    ;Decrement file count
;
add.w    #FS_NEXT,a0        ;Get address of link ptr,
lea      SV_FSLST(a6),al    ;and ptr to start of list
move.w   UT.UNLNK,a4        ;Unlink channel
jsr      (a4)
sub.w    #FS_NEXT,a0        ;Get channel block ptr
move.w   MM_RECHP,a4        ;and return space to heap
jmp      (a4)
```

Figure 2.

The long-word at offset $38(A3) in the directory device definition block specifies the length of the physical definition block required for each drive. As with the directory driver channel definition block, there are a number of reserved locations within the physical definition block. They are as seen in figure one.

Any further workspace required by the driver can be allocated by suitable adjustment of the length of the physical definition block specified in the directory driver linkage definition block. The items marked with an asterisk will be initialised by the IOSS after the block has been allocated space by the IOSS. All remaining bytes in the physical definition block will be zero.

There are five fundamental access layer calls for directory device drivers. There is one for data I/O, one for channel opening, one for channel closing, one for forced slaving and one for medium formatting. We will look now at each of these accesses in more detail, to see how we might write our access layer code. All access layer calls are in supervisor mode.

Channel Open

On entry to this access layer code, the channel definition block and the physical definition block for the appropriate drive will have been allocated already by the IOSS. Certain items within these two blocks will have been initialised. Since there is only one physical definition block for each drive, the physical definition block may not have been freshly allocated. The following registers will be set in addition to the normal settings for A3, A6, and A7:

A0 Pointer to channel definition block
A1 Pointer to physical definition block

The drive ID (FS_DRIVE) in the channel definition block will be an index into a table of physical definition block pointers starting at offset $100 from the base of the system variables. Qdos can handle a maximum of 16 drives at any time.

Note that the delete file operation is part of the channel open procedure. It is distinguished from all other forms of the call by virtue of the access mode (FS_ACCESS) in the channel definition block being negative. Definition blocks will be allocated as usual but the IOSS will also be released by the IOSS if the call returns with an error code in DO.

Each time a file is opened, on any one device, FS_FILES in the physical definition block will be incremented by the IOSS. If the open channel operation fails, the IOSS will decrement it again.

The data I/O operations for directory device drivers are identical to those for standard device drivers.

Channel Close

The channel close routine for directory device drivers is a little more complicated than for standard device drivers because the routine must unlink the channel from the list of files open and decrement the number of files open on the drive. This can be achieved through the use of the code in figure two.

The two system variables used in the channel close code are SV_FSDEF (at $100) and SV_FSLST (at $140).

On exit, register DO should be set to an appropriate error code. This will be zero normally, because most close operations will be assumed to be unable to fail. If the close operation

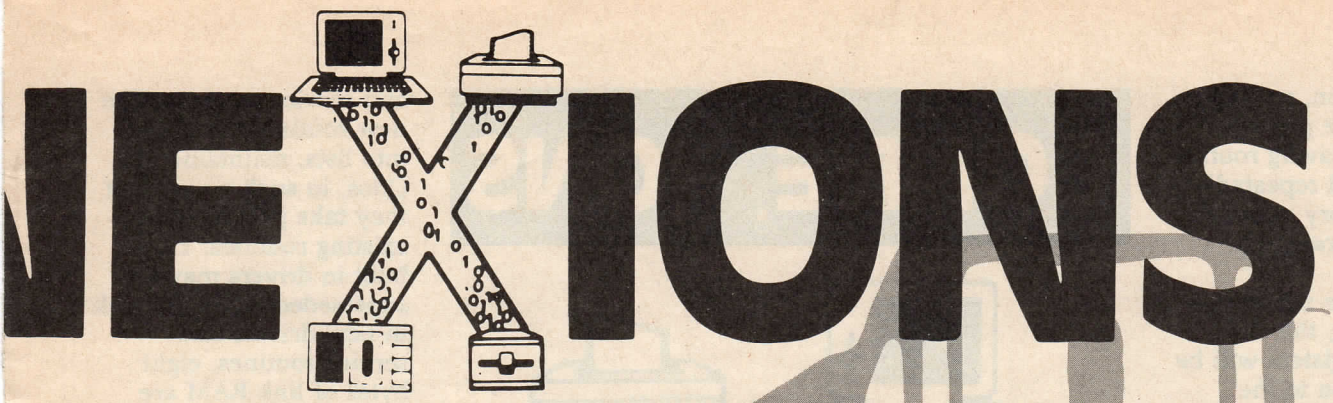


Figure 3.

Offset (A6)	Name	Use
$54	SV_BTPNT	Ptr to the most recently allocated entry in the table
$58	SV_BTBAS	Ptr to the base of the table
$5C	SV_BTTOP	Ptr to the top of the table

Figure 4.

Offset	Name	Use
$00	BT_STAT	Slave block status byte: $00 unavailable to filing system $01 empty $x3 true copy of file block $x7 updated (awaiting write) $x9 awaiting read $xB awaiting reply ('x' is the drive ID for file)
$01	BT_PRIOR	spare (byte)
$02	BT_SECTR	physical sector on medium (word)
$04	BT_FILNR	file number (word)
$06	BT_BLOCK	block number of slave block contents

cannot be completed, for example, because some I/O operation is still going on within the scheduler loop system, the channel close routine may be deferred until some later time during a scheduler loop call to the driver. In this latter case it will be the programmer's responsibility to close the channel once the I/O operation is complete.

Forced slaving

Qdos supports an area of RAM, known as the filing sub-system slave block area, between the dynamically variable SuperBasic and channel and heap areas. All the remaining RAM in the machine, at any time, is given over to filing sub-system slave blocks. The slave blocks are invisible to the user and merely duplicate data blocks, 512 bytes long, held on particular drives. With no peripheral expansion, the slave blocks will duplicate data held on the Microdrives.

There are two parts to the slave blocks. First, there is the slave block table. This is a variable size table consisting of 8-byte entries. Each entry describes a particular slave block in RAM. Second, there are the slave blocks. The whole slaving mechanism is controlled by the I/O sub-system IOSS.

There are three system variables concerned with the slave block table entries seen in figure three.

The first byte of each 8-byte table entry gives the status of the corresponding slave block and is, therefore, obligatory. The remaining seven bytes are not used by the operating system. The format of these table entries is as seen in figure four.

A slave block can be grabbed for use by a driver. The taking of such a slave block is a form of memory allocation request and must not, therefore, be attempted by anything other than access layer calls or scheduler loop calls. Only blocks which are empty, or true representations, can be taken. Once a slave block has been adopted, the system variable SV_BTPNT should be updated to correspond.

Above all it must be remembered that a slave block adopted by a routine, at any time, may not still be allocated to it by the time the access or scheduler routine is re-entered. In other words, the variable FS_CBLOK in the channel definition block is advisory only. A check on the slave block table entry must always be made.

Clearly, the use of Qdos slaving blocks is not obligatory within a directory device driver but, if slaving blocks are to be used, the appropriate link vector must be set in the device driver definition block to cope with forced slaving requests from the IOSS. Those requests occur because the memory management system requires the space for something else e.g., more common heap space.

The forced slaving routine must convert the offending block into a true copy, so that the memory manager can adopt its space. How the forced slaving routine does this will depend on what the slave block was being used for and what slave operations had reached. It is not essential that the forced slaving routine should perform the true copy

transformation, so long as it initiates the process. The forced slaving routine will be called repeatedly by the memory manager until the operation is complete.

On entry to this access layer routine, the following registers will be set in addition to the normal settings for A3, A6 and A7:

A1 Pointer to the offending block table entry
A2 Pointer to physical definition block

Formatting

On entry to this access layer routine the following registers will be set in addition to the normal settings for A3, A6 and A7:

D1 Drive number
A0 Pointer to medium name

On exit, the following registers should be set:

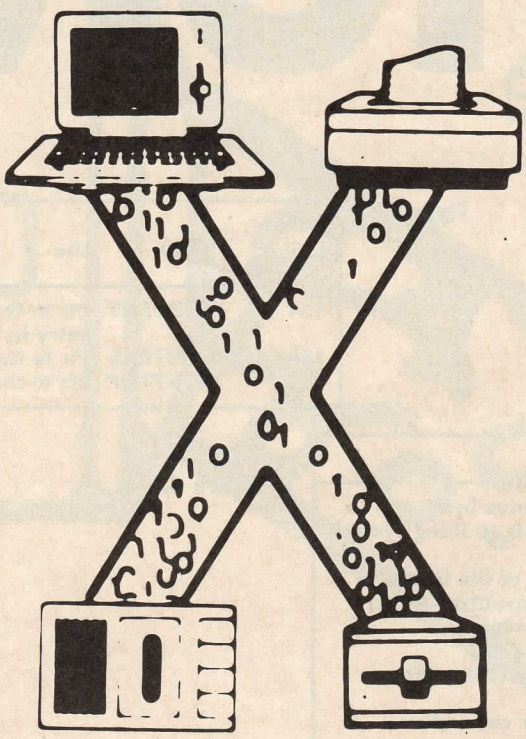
DO Error code, one of:
ERR.OM (-3) Out of memory
ERR.NF (-7) Drive not found
ERR.IU (-9) Drive in use
ERR.FF (-14) Format failed
Zero Format OK
D1 Number of good sectors
D2 Total number of sectors

A copy of the medium name will be made by the IOSS in the physical definition block at FS_MNAME offset $16. It will not be removed if the format fails.

When creating device drivers there are a number of TRAP #1 and utility system procedures and functions of particular use. Reference has been made to some of them earlier in this series and the software developed for the Qontrol-II boards also makes use of them.

Ten Qdos routines are of particular use in TRAP #1 calls. All of them concern the linking and removing of service

CONNEXIONS



routines and device drivers. The TRAP #1 procedures are accessed with register DO byte indicating which particular call is required. This register is used also to return an error status long-word to the calling process. If the error code returned is not zero an error has occurred. Small negative error codes are used to indicate standard errors.

These error codes are listed in the March issue of *QL World* and also in Appendix C of *QL Assembler Language Programming* by McGraw-Hill.

If the trap call invoked some form of additional device driver, the error code returned can be a pointed to a specific error message. So that the two types of error return code might never be confused, the pointer type error code is a pointer to an address $8000 below that of the true error message. Potentially, all Qdos routines can return the error ERR.BP (-15), signifying bad parameter.

The full descriptions of these TRAP #1 procedures, given later, state which additional errors can be returned. It would be wise to check for any errors after the trap call has been made.

In addition to the use of register DO, data registers D1 to D3 and address registers A0 to A3 are used variably to pass values to and from the Qdos procedures. When the appropriate registers have been set for any one call the appropriate routine is accessed by executing the TRAP #1 instruction. In cases where the data size qualifier, i.e., .B, .W, or .L is not specified within the description, the default is long-word i.e., .L.

Device drivers and associated services routines have been covered in detail. The main points relating to the TRAP #1 calls are worth repeating. The operating system may be extended both in terms of available device drivers and service routines. The new routines are linked into lists, maintained by Qdos, in such a way that they take priority over existing routines. These built-in drivers may be superseded easily. To link in new drivers and service routines, eight bytes of link RAM are required for the three types of service:

1. **external interrupt servers**
2. **50/60Hz interrupt servers**
3. **scheduler loop tasks**

Sixteen bytes of link RAM are required for the standard driver block and at least 44 bytes of link RAM are required for the directory driver block. This means that the total amount of link RAM allocated should be at least 40 ($28) bytes if it is to be used as a standard device driver definition block, or at least ($40) bytes if it is to be used as a directory device driver definition block. Particular links within the RAM must be set by the device driver initialisation code and Qdos informed by use of the appropriate TRAPs.

The RAM used for these lists must be allocated by a job before the link is made. The RAM may be in the resident procedure area or it may be in the common heap area. If the common heap area is used, the space must be owned by job zero so that it cannot be force removed.

The operating system will crash if the list space is zapped before the link is made. For each service or device driver there is a TRAP call to link the routine and a second TRAP call to remove the routine.

Next month we discuss the Qdos TRAP and utility calls in detail. After that we look at our first Qontrol-II board and its associated ROM.

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Incompatible printer

Recently I bought a Q-Connect module from Tandata and have found subsequently that my printer is incompatible with it. Tandata tells me that I must use an Epson-compatible printer at 9,600 baud. I do not want to have to buy a new printer just to get hard-copy from the modem interface. Is there any way to overcome this problem? I was told by Tandata that the system envisaged by me would work and that I cannot have my money refunded.

Name and address supplied.

I contacted Tandata and it is all a matter of exactly what you are trying to do. Certainly the Q-Connect module will not interfere with your serial printer plugged into SER1. The point about baud rates is a tricky one. There may well be a problem if your printer cannot run at 9,600 band and you want to operate both the printer and the modem at the same time.

That is because the modem software will set the baud rates as necessary for communications and the QL serial ports cannot have differing baud rates. So when SER2 — Q-Connect port — becomes set, so does SER1 — printer port.

If you wanted to copy viewdata-style pages to your printer, you have one additional point to consider. Viewdata systems use a particular graphics character set. In this set each graphics character is split into a 2×3 matrix of blobs and any combination of the six blobs may be highlighted so that you can see them. This, if your binary arithmetic is good, will tell you that there are 64 basic graphics character shapes. Not all printers support this graphics character set — Epson printers do. It is not important for your printer to be able to produce bit image graphics.

I am a little surprised that Tandata is not willing to see your dilemma, bearing in mind you asked explicitly about the suitability of its module with your printer. It is normally a very helpful organisation. In any event, if it sold you a module as being fit for a specified purpose and that proves not to be the case, under the Trade Descriptions Act I doubt the company can refuse to refund your money.

Visible cursor

I have been writing some utility software for my business in SuperBasic. In a number of places I want to see the cursor moving round in a window to provide editing facilities. I can always get the editing to work but I can find no way of switching the cursor on within the individual windows. Am I missing something? Is there a SuperBasic command to achieve what I want? It is most infuriating not knowing the exact point where any editing will occur.

K. Davies, Gosport, Hampshire.

You are not missing something — SuperBasic is. When input is expected within a particular window channel, you might reasonably expect Basic to flash a cursor at that point on the screen but it does not. If you had Tony Tebby's Toolkit II ROM Cartridge from Care Electronics you would be able to toggle the cursor on and off in any window by using the commands CURSEN #n and CURDIS #n respectively, where 'n' is the Basic channel number. Assuming this is not the case, you will find the program shown in Figure one of equal value.

This piece of assembly language adds a new keyword to SuperBasic, called CURSET. This

```
100  REMark CURSET Extension Loader
110  :
120  base=RESPR(256)
130  FOR index=0 to 149
140  READ value
150  POKE base+index, value
160  NEXT index
170  CALL base
180  STOP
190  :
200  REMark Program Data
210  DATA 67,250,0,12,52,120,1,16,78,146
220  DATA 112,0,78,117,0,1,0,16,6,67
230  DATA 85,82,83,69,84,0,0,0,0,0
240  DATA 0,0,66,134,32,13,144,139,12,0
250  DATA 0,16,102,0,0,98,8,54,0,7
260  DATA 184,1,103,0,0,88,47,13,81,77
270  DATA 47,13,52,120,1,18,78,146,38,95
280  DATA 42,95,102,0,0,68,63,54,152,0
290  DATA 52,120,1,18,78,146,48,95,102,0
300  DATA 0,52,120,15,12,118,0,0,152,0
310  DATA 103,2,120,14,60,8,204,252,0,40
320  DATA 220,174,0,48,188,174,0,52,108,0
330  DATA 0,26,32,118,104,0,48,8,107,0
340  DATA 0,16,16,4,54,60,255,255,78,67
350  DATA 78,117,112,241,78,117,112,250,78,117
```

Figure 2. CURSET (BASIC Loader Version)

procedure name must be followed by two parameters, the SuperBasic window channel number and a flag to say whether you want the cursor on or off. The channel number must be preceded by a hash (#) symbol and the flag should take the value zero to switch off the cursor. Any other value for the flag will switch the cursor on. For example:

CURSET #1,0 Switch window #1 cursor off
CURSET #2,1 Switch window #2 cursor on

A number of error checks are included in the code. If you do not supply both parameters, or the first parameter is not preceded by a hash symbol, you will get the error 'bad parameter'. If you specify a Basic channel number which is not open you will get the 'channel not open' error.

You should always set the cursor on in a window before performing any kind of input via the keyboard to that window. After the input has been received you can switch off the cursor again if you wish.

If you have an assembler you could type-in the program in figure one and then assemble it. Save the binary object code to Microdrive or disc and call it, say 'curset_code'. The object code will be 150 bytes long and you will need to create a small boot program to inform Basic of the additional keyword. The following would be suitable:

```
10 base=RESPR(256)
20 LBYTES mdv1_curset_code,base
30 CALL base
```

The assembler I used was the McGraw-Hill Assembler/Editor. If you use a different one, some minor changes will be required to the source program format. If you do not have an assembler, the Basic program shown in Figure two will do everything for you. Whenever you need this cursor extension code, LRUN the program. Note that whether you use the assembler approach or the Basic program loader approach, you need only to tell SuperBasic once after every re-set of the QL. Thereafter the CURSET command will become a constant and resident part of the SuperBasic language.

Figure 1. Assembly listing for CURSET — McGraw-Hill Assembler

```
*H CURSET source
;
;_____Initialisation_____
cset:     lea       pdef(pc),a1      ;set up definitions
          move.w    $110,a2          ;BP_INIT
          jsr       (a2)
          moveq     #0,d0            ;no errors
          rts
;
;_____Procedure name definition_____
pdef:     defw      1                ;1 procedure
pnam:     defw      cur-pnam         ;offset to code
          defb      6,'CURSET'       ;name
          align
          defw      0,0,0            ;no functions
;
;_____Main code for CURSET_____
cur:      clr.l     d6               ;clear channel number
          move.l    a5,d0            ;2 parameters?
          sub.l     a3,d0
          cmp.b     #16,d0
          bne       err_bp           ;no, so error
          btst      #7,1(a6,a3.l)    ;1st param has #?
          beq       err_bp           ;no, so error
          move.l    a5,-(a7)         ;save top
          subq      #8,a5            ;set new top
          move.l    a5,-(a7)
          move.w    $112,a2          ;get 1st int. (CA_GTINT)
          jsr       (a2)
          move.l    (a7)+,a3         ;set A3, A5 for 2nd param
          move.l    (a7)+,a5
          bne       err_bp           ;1st parameter no good!
          move.w    0(a6,a1.l),-(a7) ;save channel no.
          move.w    $112,a2          ;get 2nd int. (CA_GTINT)
          jsr       (a2)
          move.w    (a7)+,a0         ;retrieve channel no.
          bne       err_bp           ;2nd parameter no good!
          moveq     #15,d4           ;assume cursor off
          cmp.w     #0,0(a6,a1.l)    ; leave off?
          beq.s     croff
          moveq     #14,d4           ;no, switch on!
croff:    move.w    a0,d6            ;get channel number and
          mulu      #$28,d6          ;make channel a pointer
          add.l     $30(a6),d6       ;to channel table.
          cmp.l     $34(a6),d6       ;within table?
          bge       err_no           ;no, not open . . .
          move.l    0(a6,d6.l),a0    ;ok, collect channel ID
          move.w    a0,d0            ;is it open?
          bmi       err_no           ;no, not open . . .
          move.b    d4,d0            ;set TRAP code
          move.w    #-1,d3           ;and timeout
          trap      #3
          rts                        ;finish as appropriate.

;_____Possible errors_____
err_bp:   moveq     #-15,d0          ;bad parameters
          rts
err_no:   moveq     #-6,d0           ;channel not open
          rts
;
end
```

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Most important, you must keep Imperia from invading Earth, a planet which must be allowed to continue developing on its own. Eventually, it is hoped that you will be able to conquer Imperia.

The way to achieve these goals is to land on one of the planets in the area and stimulate its economy, so that you can afford to buy the vast range of weaponry available on the market. The Federation will sell you whatever you need but you must work for it.

To become rich you must produce industrial goods. This requires a large and motivated labour force and a high level of technology. To keep the workforce happy, you must feed them well, which requires grain. This may be bought as agricultural technology, or even used as currency but is best home-grown. The high level of technology is achieved by buying industrial technology from the Federation.

The user is presented with a menu, which is self-explanatory. The keys used throughout the program are <SPACE BAR>, to toggle about and <ENTER> to select an option. The introductory screen takes some 20 seconds to appear, so do not panic. The layout is as follows:

Top left, right: indicators of vertical and horizontal speeds respectively. *Left, right:* these are message display windows.

Bottom left: this is the Important Update window. It tells of any invasions.

Bottom right: The status window. Messages are scrolled up and it is always advisable to read them. *Top:* Fuel gauge. *Bottom:* Galaxy map. This shows all the astral objects in the area — white squares. Any enemy stars appear red. Your starship is a flickering green square. It is recommended that you refer to the map to get around.

Finally, in the centre of the screen is the windscreen. When you get close to a star, you will see it gradually growing on this panel.

There are several types of objects floating about on the QL memory banks:

★ *Black holes,* which you are advised to avoid.
★ *Nebulae,* which tend to do you no good, and zap your ship to a random location.
★ *Pulsars,* which make a good deal of noise, pulsate, and can be landed on.
★ *Planets:*
— Ringed type: look like Saturn.
— Normal: self-descriptive.
— Double: two, turning round each other.

To land on a planet, you must first make sure you see the planet on your windscreen. Then try to get closer i.e., make the planet come towards the centre of the screen. At a certain stage, a message will appear: '<SPACE BAR> TO ENTER ORBIT'. The orbit screen takes a few seconds to appear.

Once in orbit, you will have the opportunity to land on the planet. Before you do that, it is always useful to consult the Federation's Free Guide, called here Information, which will give you important information on the planet. To land, follow the instructions posted on the far right of the orbit screen.

You must land with a speed that is smaller than the maximum velocity. Three parameters are posted on the screen — fuel, altitude, and velocity. The action, like the rest of the game so far, is real-time, so it is advisable not to look at the little landing module but to concentrate on the gallons and metres per second.

All you have to do is press the up arrow to counteract the gravity. If you are overtaken by zeal and press the arrow too much, you will rise and eventually return to orbit. If you land too fast, the computer will let you know with a suitable display.

Once on the planet, the lucky captain can breathe. The real-life, competitive atmosphere of space is gone. You can relax now, as you are presented with layouts giving the grain reserves, population, level of technology, assets, and so on.

There is a menu with four options:

★ *Leave planet.*
★ *Transfer/Attack:* this is used to co-ordinate all the resources of your own planets. To own a planet, all one must do is land on it, unless it is an enemy planet, in which case it does not work. To transfer from one to the other, select the original planet and then the destination. You may not transfer equipment from a planet you do not own; that is called stealing. If you happen to transfer to a planet you do not own, the computer interprets that as a decision to attack that planet.
★ *Trade:* this is where you buy what you need from the Federation. It will all seem expensive at first — Fighters, 1 million IG$. Grain, 1000 IG$ — but as you play on you will realise it is good value. Just be cautious with your funds; do not waste them in the beginning, because you might well end up broke.
★ *Continue:* this will enable you to get down to business, and plan the coming season. You will decide how to allocate your labour force, how much food to hand out, and so on.

Finally, you will be presented with an offer for intelligence. Do not feel insulted, there is no offence intended in the least. By intelligence the Federal Databanks mean Information.

Unlike the Free Guide, which this service emulates, it is not free but then you have the opportunity to look into any planet's intimate details, for a mere five percent levy on your assets. This facility is useful when you want to attack somebody and need to know how much equipment is required.

After that, the screen goes blank for a second or two and then the results of your policies are displayed on the left-hand side — morale, population and food changes, GDP. The figures on the right-hand side are adjusted automatically, and so are those on the bottom. You will

notice your Industrial and Agricultural technologies decrease by .1 every season, as they become outdated.

Although the game stops being real-time at this stage, every second which passes the Imperia build 10 more mega-ships and draft 100 more troops, making the final task even more difficult. So be swift and act decisively.

If you find the economic section impossible, be warned — I have twice managed to build assets in excess of 100 trillion, with grain reserves of five billion tons, and one million interceptors — Imperia surrendered unconditionally.

Some of the routines in this program — landing, economic, attack — are fairly accurate simulations of reality. I hope this proves to be an enjoyable game and wish players all the best.

```
1 DEFine PROCedure start: LOCal cnt, cl: cl=0: cnt
=0: ar$='STELLARIS': WINDOW 306, 156, 103, 27: PAP
ER 0
2 CLS: OVER 1: INK 7: AT 10, 0: PRINT 'Press <ESC>
 for this menu while orbiting/travelling'\\'Select
 Option Using <SPACE>, then <ENTER>': INK 7: STRIP
 0: PRINT\ 'Load unfinished game'\'Save unfinished
 game'\'New game': OVER 0: BLOCK 10, 30, 149, 120,
 4: c=0: INK 7
3 REPeat o
4 cnt=cnt+1: cl=cl+(PI/10): AT 1, (cnt*4)+3: OVER
1: CSIZE 3, 1: INK cl*2: PRINT ar$(cnt): CIRCLE 65
, 60, 5, 4, cl*4: INK 7: CSIZE 0, 0: OVER 0: IF cn
t>8 THEN cnt=0
5 IF cl>PI*3 THEN cl=0
6 IF KEYROW(1)=64 THEN c=c+1: BLOCK 10, 30, 149, 1
20, 4: PAUSE 10: IF c<4 THEN AT c+11, 25: OVER 1:
INK 0: PRINT CHR$(188): OVER 0: INK 7
7 IF c>3 THEN c=1: OVER 1: INK 0: AT c+11, 25: PRI
NT CHR$(188): OVER 0: INK 7
8 IF KEYROW(1)=1 AND c>0 THEN CLS: EXIT o
9 END REPeat o
10 SELect ON c
11 =1: AT c+11, 30: INPUT 'Enter filename: ';f$: L
OA: kc 1: ka 2: itt: msh
12 =2: AT c+11, 30: INPUT 'Enter filename: ';f$: S
Av: start
13 =3: PRINT\\, 'Mission begins in 20 seconds...':
 kc 1: kb 50: ka 2: suv: itt: msh
14 END SELect
15 END DEFine
16 DEFine PROCedure LOA: OPEN#33, 'mdv1_'&f$: INPU
T#33, aaa, bbb, acc, axis, ayis, x, y, victory, fu
el, p, q, att, rev, liv: FOR i=1 TO 32: INPUT#33,
za(i), zb(i), zc(i), zd(i), ze(i), zf(i), zg(i), z
h(i), zi(i), zj(i), zk(i), zl(i), zm(i), zn(i), zo
(i), zp(i): END FOR i
17 FOR j=2 TO 19: FOR i=2 TO 19: INPUT#33, astre(j
,i): END FOR i: END FOR j: CLOSE#33: CLS: END DEFi
ne
18 DEFine PROCedure SAv: DELETE 'mdv1_'&f$: OPEN_N
EW#33, 'mdv1_'&f$: PRINT#33, aaa\bbb\acc\axis\ayis
\x\y\victory\fuel\p\q\att\rev\liv: FOR i=1 TO 32:
PRINT#33, za(i)\zb(i)\,zc(i)\zd(i)\ze(i)\zf(i)\zg(
i)\zh(i)\zi(i)\zj(i)\zk(i)\zl(i)\zm(i)\zn(i)\zo(i)
\zp(i): END FOR i
19 FOR j=2 TO 19: FOR i=2 TO 19: PRINT#33, astre(j
,i): END FOR i: END FOR j: CLOSE#33: CLS: END DEFi
ne
20 DEFine PROCedure suv
21 aaa=0: bbb=0: acc=1: axis=8: ayis=8: x=1200: y=
900: OVER 0: OPEN#99, scr_296x40a108x140: victory=
0: fuel=1000: p=0: q=0: att=0: rev=0: liv=5
22 DIM astre(20,20): DIM astre$(50,20): var=4: RES
TORE : z=32: DIM za(z), zb(z), zc(z), zd(z), ze(z)
, zf(z), zg(z), zh(z), zi(z), zj(z), zk(z), zl(z+4
), zm(z), zn(z), zo(z), zp(z)
23 FOR astr=1 TO 50
24 sss=RND(2 TO 19): ttt=RND(2 TO 19): astre(sss,t
tt)=astr: READ a$: astre$(astr)=a$: IF astr<33 THE
N zo(astr)=sss: zp(astr)=ttt
25 END FOR astr
26 FOR i=1 TO 32: za(i)=0: zb(i)=0: zc(i)=0: zd(i)
=0: ze(i)=0: zf(i)=0: zg(i)=1: zh(i)=1: zi(i)=10:
zj(i)=RND(100 TO 300): zk(i)=RND(1000 TO 2000): zl
(i)=0: zm(i)=RND(5 TO 35): zn(i)=RND(0 TO 300)-150
: END FOR i
27 END DEFine
28 CLEAR: im=0: suv: start
29 adr$='BZQLNMZ7FKZCRCZKDCQHUD'
30 DATA 'Antares', 'Imperia', 'Betelgeuse', 'Siriu
s', 'Altair', 'Polaris', 'Proxima Centauri', 'Alph
a Centauri', 'Castor', 'Pollux', 'Procyion', 'Cape
lla', 'Adelbaran', 'Dubhe', 'Rigel', 'Regulus'
31 DATA 'Cluren', 'Stella Terriytorei', 'Andromeda
e', 'Arcturus', 'Cassiopeiae', 'Mu Hydrae', 'X.Cyg
ni', 'Tau CrB', 'Alpha Herculis', 'Mu Cephei', 'Al
pha Orionis', 'Alcor', 'Beta Persei'
32 DATA 'Lambda Tauri', 'Delta Librae', 'EARTH', '
M7', 'M1321', 'M12', 'M557', 'M21319', 'M3', 'M763
', 'M19256', 'Pleiades', 'Great', 'Omega', 'Horse'
, 'Chronos', 'Alluvien', 'Oneris', 'Anomrac', 'Clo
ud', 'Serena'
33 DEFine PROCedure itt: INK 7: FILL 0: WINDOW 512
, 256, 0, 0: PAPER 0: BORDER 6, 4: CLS: RESTORE 34
34 DATA 115, 55, 106, 30, 70, 75, 221, 30, 115, 55
, 291, 30, 115, 40, 106, 85, 115, 40, 291, 85, 115
, 55, 106, 125, 70, 75, 221, 105, 115, 55, 291, 12
5, 60, 150, 26, 30, 60, 150, 420, 30, 207, 60, 305
, 186, 60, 20, 26, 80, 60, 20, 420, 80, 205, 60, 0
, 186, 93, 66, 209, 189, 100, 20, 10, 0, 100, 20,
400, 0, 100, 20, 206, 0
35 FOR i=3 TO 20
36 OPEN#i, scr_: READ a, b, c, d: WINDOW#i, a, b,
c, d: PAPER#i, 0: INK#i, 7: CLS#i: IF i>10 THEN BO
RDER#i, 3, 4
37 END FOR i
38 zl(2)=2: FOR ac=2 TO 19
39 FOR dc=2 TO 19
40 IF astre(ac,dc)>0 THEN BLOCK #17, 4, 3, (ac-1)*
4, (dc-1)*3, 7
41 IF astre(ac,dc)<33 && astre(ac,dc)>0: IF zl(ast
re(ac,dc))=2 THEN BLOCK#17, 4, 3, (ac-1)*4, (dc-1)
*3, 2
42 END FOR dc
43 END FOR ac
44 am=astre(axis,ayis): WINDOW 306, 156, 103, 27:
BORDER 3, 2: BORDER#11, 3, 2: BORDER#12, 3, 2: PAP
ER 0: CLS: map 4: CLS: FOR po=1 TO 50: POINT RND(1
80), RND(100): END FOR po
45 FOR i=-16 TO 16 STEP 2: BLOCK#18, 2, 2, 43+(i*2
), 10, 4: BLOCK#19, 2, 2, 43+(i*2), 10, 4: END FOR
 i: BLOCK#18, 2, 3, 43, 9, 2: BLOCK#19, 2, 3, 43,
9, 2: CURSOR#18, 0, 4: INK#18, 2: INK#19, 2: PRINT
#18, CHR$(188): CURSOR#18, 82, 4: PRINT#18, CHR$(1
89): CURSOR#19, 0, 4: PRINT#19, CHR$(190): CURSOR#
19, 82, 4: PRINT#19, CHR$(191)
46 CURSOR#20, 0, 2: PRINT#20, 'FUEL:': BLOCK#20, 5
2, 12, 32, 1, 4: BLOCK#20, 50, 10, 33, 2, 2: INK#1
3, 7: INK#16, 4: STRIP#13, 2: g0=0: g1=0: g2=0: g3
=0: g4=0: g5=0: g6=0: TIME=DATE: ka 0: BEEP: END D
EFine
47 DEFine PROCedure m: qw=-ABS(aaa)-1: we=ABS(bbb)
+1: PAN#3, qw: SCROLL#3, -we: PAN#6, qw: PAN#8, qw
: SCROLL#8, we: SCROLL#9, we: SCROLL#10, we: PAN#1
0, -qw: PAN#7, -qw: PAN#5, -qw: SCROLL#5, -we: SCR
OLL#4, -we: END DEFine
48 DEFine PROCedure check
49 IF am>40 THEN RECOL 0, 1, 0, 3, 0, 5, 6, 7
50 map 7: c=(y-50)/100: ayis=INT(c): aa=(x+75)/150
: axis=INT(aa): map 4: am=astre(axis,ayis): IF am>
0 THEN pri=1: movestar
51 END DEFine
52 DEFine PROCedure see_star: BLOCK#20, 50, 10, 33
, 2, 0: BLOCK#20, fuel/20, 10, 33, 2, 2: pos_x=(x+
75)-(axis*150): pos_y=(y-50)-(ayis*100): b1=150-po
s_x: b2=pos_y: END DEFine
53 DEFine PROCedure movestar: see_star
54 REPeat o
55 key_row: col=1: what_star: enemy: col=0: what_s
tar: q=50-ABS(b2-50): p=75-ABS(b1-75): IF am<41 TH
EN m
56 FILL 0: INK 7: FOR aye=1 TO 2: POINT RND(180),
RND(100): END FOR aye: b1=b1-aaa: b2=b2+bbb: checo
r: check_star
57 END REPeat o
58 msh: END DEFine
59 DEFine PROCedure msh
60 REPeat ooo
61 IF fuel>0 THEN key_row
62 checor: check: m: enemy: mem: INK 7: FILL 0: FO
R aye=1 TO 3: POINT RND(150), RND(100): END FOR ay
e
63 END REPeat ooo
64 END DEFine
65 DEFine PROCedure map (var)
66 IF var=7 AND  astre(axis,ayis)>0 THEN BLOCK #17
, 4, 3, (axis-1)*4, (ayis-1)*3, 7
67 IF var=7 AND  am<33: IF zl(am)=2 AND astre(axis
,ayis)>0 THEN BLOCK #17, 4, 3, (axis-1)*4, (ayis-1
```

```
)*3, 2
68 IF var=7 AND astre(axis,ayis)=0 THEN BLOCK #17,
 4, 3, (axis-1)*4, (ayis-1)*3, 0
69 IF var=4 THEN BLOCK #17, 4, 3, (axis-1)*4, (ayi
s-1)*3, 4
70 END DEFine
71 DEFine PROCedure check_star
72 map 7: c=(y-50)/100: ayis=INT(c): aa=(x+75)/150
: axis=INT(aa): map 4: IF astre(axis,ayis)=am THEN
 RETurn
73 col=0: what_star: msh: END DEFine
74 DEFine PROCedure what_star:
75 IF am>0 AND am<12 THEN simplestar
76 IF am>11 AND am<20 THEN saturn
77 IF am>19 AND am<27 THEN BEEP 0, 1, 19, 69, 81,
43, 52, 8: pulsar
78 IF am>26 AND am<33 THEN binarystar
79 IF am>32 AND am<41 THEN BEEP 0, 1, 19, 69, 81,
43, 32, 0: blackhole
80 IF am>40 AND am<51 THEN nebula
81 END DEFine
82 DEFine PROCedure key_row: BEEP
83 IF KEYROW(1)=8 THEN start
84 k=KEYROW(1)
85 IF k&&2: IF aaa>-15: aaa=aaa-2: kc 0: xpeed
86 IF k&&16: IF aaa<15: aaa=aaa+2: kc 0: xpeed
87 IF k&&4: IF bbb>-15: bbb=bbb-2: kc 0: yspeed
88 IF k&&128: IF bbb<15: bbb=bbb+2: kc 0: yspeed
89 END DEFine
90 DEFine PROCedure xpeed: BLOCK#18, 10, 7, 39+(aa
a*2), 1, 0: BLOCK#18, 2, 7, 43+(aaa*2), 1, 2: fuel
=fuel-2: see_star: END DEFine
91 DEFine PROCedure yspeed: BLOCK#19, 10, 7, 39+(b
bb*2), 1, 0: BLOCK#19, 2, 7, 43+(bbb*2), 1, 2: fue
l=fuel-2: see_star: END DEFine
92 DEFine PROCedure checor
93 IF x+aaa>=150 AND x+aaa<=3000 AND y+bbb>=150 AN
D y+bbb<=2100 THEN x=x+aaa: y=y+bbb: ELSE write 'W
arning!  Approaching Galactical Fringe!'
94 END DEFine
95 DEFine PROCedure simplestar: message '', 'Appro
aching '&astre$(am): atn
96 IF col=1 THEN FILL 1: INK 211: CIRCLE b1, b2, 5
E-3*(p*q): INK 50: ARC b1, b2+5E-3*(p*q) TO b1, b2
-5E-3*(p*q), 2: FILL 0
97 IF col=0 THEN FILL 1: INK 0: CIRCLE b1, b2, (5E
-3*(p*q))+1: FILL 0
98 END DEFine
99 DEFine PROCedure pulsar: message '', 'Approachi
ng Cosmic PULSAR system'&astre$(am): atn
100 IF col=1 THEN OVER -1: FILL 1: INK 2: CIRCLE b
1, b2, 2E-3*(p*q): FILL 0: INK 50: FOR i=1 TO 3: C
IRCLE b1, b2, 2E-3*(p*q)+i: END FOR i: OVER 0
101 IF col=0 THEN FILL 0: INK 0: FOR i=3 TO 0 STEP
 -.3: CIRCLE b1, b2, 2E-3*(p*q)+i: END FOR i: FILL
 1: CIRCLE b1, b2, 10
102 END DEFine
103 DEFine PROCedure blackhole: message 'WARNING!'
,' Approaching  BLACK HOLE'&astre$(am): atn
104 IF col=1 THEN INK 2: FOR i=1 TO 7: CIRCLE b1+(
i*((75-b1)/20)), b2+(i*((50-b2)/20)), (7E-3*(p*q))
-i: END FOR i
105 IF col=0 THEN INK 0: FOR i=7 TO 1 STEP -1: CIR
CLE b1+(i*((75-b1)/20)), b2+(i*((50-b2)/20)), (7E-
3*(p*q))-i: END FOR i
106 END DEFine
107 DEFine PROCedure binarystar: message '', 'Appr
oaching  Binary Star  System'&astre$(am): atn
108 IF col=1 THEN INK 2: FILL 1: qq=.2*(50-b2): CI
RCLE b1, b2, 5E-3*(p*q): FILL 0: INK 0: FILL 1: CI
RCLE b1+(75-b1)/3, b2+qq, 2E-3*(p*q): FILL 0: INK
 2: CIRCLE b1+(75-b1)/3, b2+qq, 2E-3*(p*q)
109 IF col=0 THEN INK 0: FILL 1: CIRCLE b1, b2, 5E
-3*(p*q): FILL 0: FILL 1: CIRCLE b1+(75-b1)/3, b2+
qq, 2E-3*(p*q)+10: FILL 0
110 END DEFine
111 DEFine PROCedure saturn: message '', 'Approach
ing '&astre$(am): atn
112 re=5E-3*(p*q): IF col=1 THEN INK 2: ARC b1-(re
*.9), b2-(re*.9) TO b1+(re*.9), b2+(re*.9), -1.5:
INK 241: FILL 1: CIRCLE b1, b2, re: INK 2: FILL 0:
 ARC b1-(re*.9), b2-(re*.9) TO b1+(re*.9), b2+(re*
.9), 1.5
113 IF col=0 THEN INK 0: FILL 1: CIRCLE b1, b2, 9E
-3*(p*q): FILL 0
114 END DEFine
115 DEFine PROCedure nebula: FOR i=1 TO 3: INK RND
(2 TO 4): FILL RND(3): CIRCLE RND(150), RND(100),
RND(3): FILL 0: INK 7: POINT RND(150), RND(100): E
ND FOR i: message '', 'Entering '&astre$(am)&' Neb
ula': END DEFine
116 DEFine PROCedure message (special$, msg$)
117 IF b1>30 AND b1<120 AND b2>30 AND b2<80 AND pr
i=1 THEN RECOL#13, 0, 1, 0, 3, 4, 5, 6, 7: SCROLL#
13, -10: AT#13, 4, 0: PRINT#13, special$&msg$: pri
=pri-1: IF am<33 THEN CLS#12: INK#12, 4: PRINT#12,
 \\\\'TO ENTER'\' ORBIT:'\\\'(space)': INK#12, 2:
FILL#12, 1: CIRCLE#12, 12, 52, 5: BLOCK#12, 11, 3,
 18, 68, 7
118 IF (b1<30 OR b1>120 OR b2<30 OR b2>80) AND pri
=0 THEN write 'End of approach': pri=pri-1: CLS#12
119 IF am>40 AND b1>40 AND b1<110 AND b2>30 AND b2
<70 THEN write 'Entering time warp': x=RND(150 TO
2850): y=RND(200 TO 1900): RECOL 6, 1, 6, 3, 6, 5,
 0, 7: RECOL 6,.1, 2, 3, 4, 5, 0, 7: check
120 END DEFine
121 DEFine PROCedure orbit: ka 2: write 'ATTENTION
 -- PROCEEDING TO ORBIT': FOR i=1 TO 150: END FOR
i:RESTORE 125
122 OPEN#100, scr_: WINDOW#100, 2.3E-2*(xxp*xxq),
1.6E-2*(xxp*xxq), 108+2*(b1-(5E-3*(xxp*xxq))), 29+
(1.5*(100-b2-(5E-3*(xxp*xxq)))): FILL 1: INK 4: r=
-3.1: in=4: IF am>11 AND am<20 THEN FILL 0: CLS: F
OR i=1 TO 10: INK 50: CIRCLE b1, b2, 5E-3*(xxp*xxq
)*1.3+((i/3)+2), 2, .5: CIRCLE b1, b2, 5E-3*(xxp*x
xq)*1.3+((i/7)+13)*3, 2, .5: CIRCLE b1, b2, 5E-3*(
xxp*xxq)*1.3+((i/5)+7)*3, 2, .5: END FOR i: INK 0
123 CIRCLE b1, b2, ((xxp*xxq)*5E-3): FILL 0: FILL
1
124 IF am>26 AND am<33 THEN CIRCLE b1+(75-b1)/3, b
2+qq, ((xxp*xxq)*3E-3): FILL 0: FILL 1
125 DATA -3.1, -3, -2.8, -2.4, -2, -1.3, -.5, .5,
1.3, 2, 2.4, 2.8, 3, 3.1
126 FOR pq=1 TO 14
127 READ qp: INK in
128 ARC b1, b2-((xxp*xxq)*5E-3) TO b1, b2+((xxq*xx
p)*5E-3), qp
129 in=in-2: IF in<2 THEN in=4
130 END FOR pq
131 FILL 0: FILL 1
132 RESTORE 125
133 FOR pq=1 TO 14
134 READ qp: INK in: IF am>26 AND am<33 THEN ARC b
1+(75-b1)/3, qq+b2+3E-3*(xxp*xxq) TO b1+(75-b1)/3,
 qq+b2-3E-3*(xxp*xxq),qp: in=in-2: IF in<2 THEN in
=4
135 END FOR pq
136 FILL 0: IF am<11 THEN FOR i=1 TO 24: FILL 1: I
NK 6: CIRCLE RND(b1-30 TO b1+30), RND(b2-30 TO b2+
30), RND(2)/2: FILL 0: END FOR i: INK 0
137 FILL 0: write 'NOW IN ORBIT': CLS#12: FILL#12,
 1: INK#12, 4: PRINT#12, 'TO  LAND'\' PRESS'\\\\'T
O LEAVE'\' ORBIT'\\\\'FOR INFO'\' PRESS': OVER#12,
 1: INK#12, 2: CIRCLE#12, 12, 80, 5: CIRCLE#12, 12
, 45, 5: CIRCLE#12, 12, 10, 5: INK#12, 7: CURSOR#1
2, 20, 25: PRINT#12, 'L': CURSOR#12, 20, 75: PRINT
#12, 'B': CURSOR#12, 20, 125: PRINT#12, 'I': OVER#
12, 0:ka 0: BEEP
138 REPeat o
139 RECOL#100, 0, 1, 4, 3, 2, 5, 6, 7: enemy: IF I
NT(DATE/5)*5=DATE THEN INK 7: POINT RND(0 TO 150),
 RND(1 TO 100)
140 IF KEYROW(2)=16 THEN CLS#100: write 'OUT OF OR
BIT': FOR i=18 TO 20: RECOL#i, 0, 1, 2, 3, 2, 5, 4
, 7: END FOR i: CLS: CLS#12: p=xxp: q=xxq: msh
141 IF KEYROW(1)=8 THEN start
142 IF KEYROW(4)=1 THEN land
143 IF KEYROW(5)=4 THEN intel: orbit
144 END REPeat o
145 END DEFine
146 DEFine PROCedure atn
147 IF b1>30 AND b1<120 AND b2>20 AND b2<80
148 IF KEYROW(1)=64 AND am>0 AND am<33 THEN FOR i=
18 TO 20: RECOL#i, 0, 1, 4, 3, 6, 5, 6, 7: END FOR
 i: kc 1: xxp=p: xxq=q :orbit
149 IF am>32 AND am<41 AND b1>60 AND b1<90 AND b2>
35 AND b2<65 THEN  write 'NO ESCAPE. SURVIVAL CHAN
CES NILLCOMPUTER OUT': CLS: INK 7: FOR j=1 TO 2: q
1=1: FOR i=1 TO 31: CIRCLE i*2, 100-(i*2), q1: q1=
q1*1.15: END FOR i: INK 0: ka 8: END FOR j: lives:
 x=RND(200 TO 2800): y=RND(200 TO 1800): am=0: CLS
: ka 0: msh
150 END IF
151 END DEFine
152 DEFine PROCedure land: LOCal acc, a, b, c, d,
e, mass, fuels, v, i, s, F, h, dec: ka 2: write 'L
anding...': CLS#12: FILL#12, 1: INK#12, 4: PRINT#1
2, \\\'TO  FIRE'\\'BOOSTERS'\\' PRESS': INK#12, 2:
 OVER#12, 1: CIRCLE#12, 12, 32, 5: INK#12, 7: CURS
OR#12, 20, 92: PRINT#12, CHR$(190): STRIP#12,0
```

```
153 CLS: s=0: RESTORE 154: WINDOW#100, 20, 7, 225,
 48: WINDOW#2, 20, 120, 225, 30: FOR i=1 TO 20: IN
K RND(2 TO 7): POINT RND(118 TO 132)/2, RND(168 TO
 176)/2: END FOR i: INK 4
154 DATA 14, 2, 99, 51, 7, 12, 4, 100, 50, 7, 8, 1
, 102, 49, 4, 8, 2, 102, 54, 4, 3, 2, 101, 56, 4,
3, 2, 108, 56, 4, 6, 1, 103, 48, 4, 2, 5, 105, 43,
 7
155 FOR i=1 TO 8: READ a, b, c, d, e: BLOCK a, b,
c+20, d-40, e: END FOR i: FILL 1: INK 241: CIRCLE
75, -310, 330: FILL 0: INK 4
156 fuel=fuel-25: fuels=250: acc=zm(am): mass=8000
+(fuels*10): v=0: s=0: d=500: F=20000: h=48: PAPER
#2,0: dec=0: PRINT\'ALTITUDE (km)'\\\\\'!!!WARNING
!!!'\'MAX.  LANDING'\'VELOCITY:  ';acc: AT 1, 34:
PRINT 'VELOCITY (km/h)': AT 9, 34: PRINT 'FUEL (kg
)': ka 0
157 REPeat down
158 v=v+acc-dec: s=v+(.5*(acc-dec)): d=d-s: dec=0:
 AT 3, 0: INK 7: PRINT ' '!INT(d)!' ': AT 3, 40: P
RINT ' '!INT(v)!' ': AT 11, 40: PRINT ' '!fuels!'
': IF d<5 AND v<=acc  THEN write 'LANDED SAFELY.':
 CLS#12: EXIT down
159 IF d<5 AND v>acc THEN ka 8: INK 7: FOR i=1 TO
25 STEP 2: CIRCLE 60, 20, i: END FOR i: write 'CRA
SHED': lives: CLS: orbit
160 IF d>600 THEN write 'RETURNING TO ORBIT': ka 2
: CLS: FILL 1: INK 4: CIRCLE 75, 50, 90:FILL 0: ka
 0: kc 1: INK 0: FOR i=90 TO 15 STEP -.5: CIRCLE 7
5, 50, i: END FOR i: INK 4: CLS: orbit
161 SCROLL#2, s/5: h=h+s/5: WINDOW#100, 20, 7, 225
, h: ti=DATE
162 REPeat fuell
163 IF DATE>ti+1 THEN EXIT fuell
164 IF fuels>0 AND KEYROW(1)=4 THEN BEEP 3000, 18,
 0, 0, 0, 0, 26, 0: fuels=fuels-1: mass=mass-1: de
c=dec+(F/mass): RECOL#100, 0, 1, 4, 3, 6, 5, 2, 7
165 END REPeat fuell
166 END REPeat down
167 IF zl(am)<>2 THEN zl(am)=1: king
168 IF zl(am)=2 THEN write 'Your landing party was
 captured': write'by enemy Space Guards.': kb 10:
lives: CLS: orbit
169 END DEFine
170 DEFine PROCedure king: INK 7: de=0: fs=0: CLS:
 troops=50: ht=0: main: END DEFine
171 DEFine PROCedure main
172 REPeat loppp
173 season$='WINTER': eat=1.3: wt=1.5: feed: enemy
: results: season$='SPRING': eat=1.2: wt=1.7: feed
: pd=fs*zi(am)*zh(am): IF pd>sd THEN pd=sd
174 results: season$='SUMMER': eat=1.1: wt=1.8: en
emy: feed
175 IF fs*zi(am)*zh(am)<pd THEN a=pd-fs*zi(am)*zh(
am): write 'Grain lost though neglect: '&a&'Ton':
pd=INT(fs*zh(am)*zi(am))
176 results: season$='AUTUMN': eat=1.2: wt=1.6: fe
ed: enemy: ht=(((pd*fs*zi(am)*(zh(am)^(1/2)))^(3/5
))): zk(am)=zk(am)+ht: results
177 END REPeat loppp
178 END DEFine
179 DEFine PROCedure feed: ka 2: f9: AT 0, 0: STRI
P 4: PRINT season$;' SEASON': STRIP 0: AT 10, 0: P
RINT 'Leave planet'\'Transfer/Attack'\'Trade with
Federation'\'Continue': BLOCK 10, 40, 142, 100, 4:
 c=0
180 INK#11,4: CLS#11: PRINT#11,\'TO  MOVE'\' ARROW
:'\\\\'(SPACE).'\\'   TO'\' SELECT'\\\\'(ENTER).':
 INK#11, 2: FILL#11, 1: CIRCLE#11, 12, 70, 5: CIRC
LE#11, 12, 20, 5: INK#11, 7: CURSOR#11, 17, 110: O
VER#11, 1: PRINT#11, 'cr': BLOCK#11, 12, 3, 17, 42
, 7: INK 7: ka 0
181 REPeat lopes
182 IF KEYROW(1)=64 THEN c=c+1: IF c<5 THEN AT c+9
, 24: BLOCK 10, 40, 142, 100, 4: OVER 1: INK 0: PR
INT CHR$(188): OVER 0: PAUSE 100: INK 7
183 IF KEYROW(1)=1 AND c>0 THEN EXIT lopes
184 IF c>4 THEN c=0
185 END REPeat lopes
186 SELect ON c
187 =1: d=700: CLS#16: GO TO 160
188 =2: transfer: CLS
189 =3: trade: CLS
190 END SELect
191 mem: f9: AT 10, 0: PRINT FILL$(' ',200): STRIP
 2: AT 14, 0: PRINT'How much  grain is to be distr
ibuted?';: STRIP 4: chinky$ zk(am): fd=vra: zk(am)
=zk(am)-fd
192 STRIP 2: SCROLL#99, -10: AT 14, 0: PRINT'How
much  grain is  to  be  planted?';: STRIP 4: chink
y$ zk(am): sd=vra
193 zk(am)=zk(am)-sd: STRIP 2: SCROLL#99, -10: AT
14, 0: PRINT'How  many people  to work in  fields?
';: STRIP 4: chinky$ zj(am): fs=vra
194 STRIP 2: SCROLL#99, -10: AT 14, 0: PRINT'How m
any people to Planetary Brigade?';: STRIP 4: chink
y$ zj(am)-fs: zd(am)=vra
195 STRIP 2: SCROLL#99, -10: AT 14, 0: PRINT'How m
any people to  work in Industry?';: STRIP 4: chink
y$ zj(am)-fs-zd(am): ws=vra
196 STRIP 2: SCROLL#99, -10: AT 14, 0: PRINT'Intel
ligence ("y" for yes)?': IF INKEY$(-1)='y' THEN SC
ROLL#99, -10: AT 14, 0: PRINT 'Cost is ';nm$(zf(am
)/20);'. Accepted?': STRIP 0: IF INKEY$(-1)='y' TH
EN zf(am)=zf(am)-(zf(am)/20): rev=1: intel: rev=0
197 a=((zj(am)-fs)*eat)+(fs*wt): IF fd>a THEN zi(a
m)=zi(am)+1: IF zi(am)<9 THEN zi(am)=9
198 IF fd<a THEN de=ABS(INT((zj(am)-(fd/eat))/3)):
 zi(am)=zi(am)-1: zj(am)=zj(am)-de: IF zi(am)>10 T
HEN zi(am)=10
199 bi=INT(zj(am)*RND(1 TO 5)/30): zj(am)=zj(am)+b
i: END DEFine
200 DEFine PROCedure results: pr=(ws)*(zi(am)^2.7)
*(zg(am)^(1/2)): zg(am)=zg(am)-.1: zh(am)=zh(am)-.
1: zf(am)=zf(am)+pr
201 IF zg(am)<.1 THEN zg(am)=.1
202 IF zh(am)<.1 THEN zh(am)=.1
203 CLS: ka 2: BLOCK 120, 70, 10, 15, 2: OVER 1: A
T 2, 2: PRINT 'Deaths: ';de: AT 3, 2: PRINT 'Birth
s: ';bi: OVER -1: AT 4, 2: PRINT 'Change: ';bi-de:
 de=0: bi=0: OVER 1
204 AT 5,2: PRINT 'Morale: ';: IF zi(am)<10 THEN a
$='low': IF zi(am)<7 THEN a$='very low'
205 IF zi(am)>=10 THEN a$='high': IF zi(am)>12 THE
N a$='very high.': IF zi(am)>13 THEN rp=RND(2): IF
 NOT rp THEN write 'Lured by high incentives.': wr
ite 'more natives join in.': zj(am)=zj(am)+INT((zj
(am)*zi(am)/100))
206 PRINT a$: AT 6, 2: OVER-1: PRINT 'Grain: ';nm$
(ht-sd-fd): PRINT '  GDP: ';nm$(pr): fd=0: sd=0: h
t=0: OVER 1
207 IF zj(am)<1 THEN write 'You have reduced this
race': write 'to a pityless end.': write 'There is
 nothing more for you': write 'to do on this plane
t.'
208 IF zi(am)<6 THEN write 'VIOLENT RIOTS, SEVERAL
 TROOPS  KILLED': troops=troops-RND(30): IF troop
s<1 THEN write 'You have been expelled': write 'fr
om this system.': zl(am)=0: lives: d=700: GO TO 16
0
209 END DEFine
210 DEFine PROCedure chinky$(lim): LOCal a$
211 STRIP 0: AT 14, 38: PRINT '          ': STRIP
 4: AT 14, 38: INPUT a$: IF a$='' THEN GO TO 211
212 IF CODE(a$)<48 OR CODE(a$)>57 THEN GO TO 211
213 vra=a$: IF vra>lim THEN GO TO 211
214 RECOL#99, 0, 1, 0, 3, 0, 5, 6, 7: END DEFine
215 DEFine PROCedure trade: LOCal u1, u2, q7, buy:
 ka 2: CLS#12: u1=0: u2=0: buy=0: CLS: c=0: BLOCK
15, 80, 141, 30, 2
216 STRIP 2: PRINT 'FEDERAL TRADE BOARD RATES'\"(M
illions IG$/Tons Grain)": STRIP 4: PRINT'COMMODITY
:',,'  QUANTITY:': STRIP 0: PRINT 'Laser:',,'
 1'\'Satellite:',' 25'\'Interceptor:  10'
\'Starship:',' 50'\'Industrial Tech:  .5'\'Ag
ricultural Tech:  .3'\'Grain:',,' .001'\'Fuel:',,
'  0.1':ka 0
217 REPeat loppo
218 IF KEYROW(1)=64 THEN c=c+1: IF c<9 THEN OVER 1
: BLOCK 15, 80, 141, 30, 2: AT c+2, 24: INK 0: PRI
NT CHR$(188): OVER 0: kb 0: INK 7
219 IF KEYROW(1)=1 AND c>0 THEN inputter : acq: EX
IT loppo
220 IF c>8 THEN c=0
221 END REPeat loppo
222 CLS#99: AT 14, 0: STRIP 2: PRINT 'Any further
queries ("y" for yes)?': STRIP 0: OVER#16, 0: INK#
16, 7: AT#16, 1, 0: PRINT#16, FILL$(' ', 64): AT#1
6, 1, 0: PRINT#16, ' Assets:  ';nm$(zf(am))\
' Grain:  ';nm$(zk(am)): IF INKEY$(-1)='y'
THEN trade
223 END DEFine
224 DEFine PROCedure acq
225 IF CODE(q7$)>47 AND CODE(q7$)<58 THEN q7=q7$
226 IF CODE(q7$)<47 OR CODE(q7$)>58 THEN q7=0
227 SELect ON c
228 =8: u1=100000: u2=100: pay: IF buy THEN fuel=f
```

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uel+q7
229 =1: u1=1E6: u2=1000: pay: IF buy THEN ze(am)=z
e(am)+q7
230 =2: u1=2.5E7: u2=25000: pay: IF buy THEN zc(am
)=zc(am)+q7
231 =3: u1=1E7: u2=10000: pay: IF buy THEN za(am)=
za(am)+q7
232 =4: u1=5E7: u2=50000: pay: IF buy THEN zb(am)=
zb(am)+q7
233 =5: u1=500000: u2=500: pay: IF buy THEN zg(am)
=zg(am)+(q7/5)
234 =6: u1=300000: u2=300: pay: IF buy THEN zh(am)
=zh(am)+(q7/5)
235 =7: u1=1000: u2=1: pay: IF buy THEN zk(am)=zk(
am)+q7
236 END SELect
237 IF fuel>1000 THEN fuel=1000
238 END DEFine
239 DEFine PROCedure pay: LOCal cq: CLS#99: BLOCK
206, 10, 0, 110, 2: OVER 1: AT 11, 0: PRINT 'Cost
is: ';nm$(q7*u1);' / ';nm$(q7*u2): OVER 0
240 AT 12, 16: PRINT 'INTERGALAX $'\,,'GRAIN'\,,'N
O PAYMENT': BLOCK 10, 30, 196, 120, 4: cq=0: AT 12
, 0: PRINT 'Payment by:': buy=0
241 REPeat lap
242 IF KEYROW(1)=64 THEN cq=cq+1: IF cq<4 THEN AT
cq+11, 33: BLOCK 10, 30, 196, 120, 4: INK 0: OVER
1: PRINT CHR$(188): OVER 0: INK 7
243 IF KEYROW(1)=1 AND cq>0 THEN kb 1: EXIT lap
244 IF cq>3 THEN cq=0
245 END REPeat lap
246 SELect ON cq
247 =3: buy=0
248 =1: IF zf(am)>=u1*q7 THEN buy=1: zf(am)=zf(am)
-(u1*q7)
249 =2: IF zk(am)>=u2*q7 THEN buy=1: zk(am)=zk(am)
-(u2*q7)
250 END SELect
251 IF buy=0 THEN STRIP 4: AT 13, 35: INK 0: PRINT
 'NO FUNDS.': STRIP 0: INK 7: kb 1
252 END DEFine
253 DEFine PROCedure attack: LOCal d0, d2, d3, d4,
 d6, d8, la: d4=ze(ad): d2=zc(ad): d0=za(ad): d3=z
d(ad): d8=zi(ad)/10: d6=zg(ad)^(1/2)
254 a1=a1-(d2^(1/2))*d6: IF a1<0 THEN a1=0
255 d2=d2-((a0/5)/d6): IF d2<0 THEN d2=0
256 a1=a1-(d0*d6*d8/10): la=a0: a0=a0-(d0*d6*d8):
d0=d0-(la/(d6*d8)): a0=a0-(d4*d6/3)
257 IF a1>0 THEN zk(ad)=zk(ad)/a1: zf(ad)=zf(ad)/a
1: d4=d4-((a1-INT(a2/10))*3/d6)
258 IF a2<0 THEN a2=0
259 IF d3<0 THEN d3=0
260 IF d0<0 THEN d0=0
261 IF a0<0 THEN a0=0
262 IF d4<0 THEN d4=0
263 IF a1<0 THEN a1=0
264 IF d2<0 THEN d2=0
265 IF a2>d3*d8*2 OR (zk(ad)<zj(ad) AND zf(ad)<(zj
(ad)*100)) THEN PRINT#16, \'System ';astre$(ad)\'h
as surrendered.': zj(ad)=zj(ad)-(zd(ad)/2): za(ad)
=a0: zb(ad)=a1: zc(ad)=a2: victory=1
266 IF victory=0 THEN zj(ad)=zj(ad)-(d3/2): zc(ad)
=d2: zd(ad)=d3: ze(ad)=d4: za(ad)=d0
267 END DEFine
268 DEFine PROCedure transfer: LOCal c$, e, c, q1,
 d, pos, dn, or, na: ka 2: na=1: c$='w': pos=0: CL
S: INK 7: write 'F1 to escape'
269 BLOCK 16, 40, 117+(pos*155), 10, 4: c=0: e=0:
FOR i=1 TO 4: AT i,0+(pos*26): PRINT astre$(i): EN
D FOR i: STRIP 4: AT 0, 0: INK 0: PRINT 'TRANSFER
FROM:',,'  TO DESTINATION:        ': STRIP 0: INK 0
: ka 0
270 REPeat luck
271 IF KEYROW(0)=2 THEN CLS: write '': RETurn
272 IF KEYROW(1)=64 THEN c=c+1: IF c<5 THEN AT c,
20+(pos*26): BLOCK 16, 40, 117+(pos*155), 10, 4: O
VER 1: INK 0: PRINT CHR$(188): OVER 0: INK 7
273 IF c=5 THEN INK 0: FOR i=e*4+1 TO e*4+4: AT i-
(e*4), (pos*26): PRINT astre$(i): END FOR i: c=1:
e=e+1: INK 7: FOR i=e*4+1 TO (e*4)+4: AT i-(e*4),
(pos*26): PRINT astre$(i): END FOR i: AT c, 20+(po
s*26): BLOCK 15, 40, 117+(pos*155), 10, 4: OVER 1:
 INK 0: PRINT CHR$(188): OVER 0: INK 7
274 IF KEYROW(1)=1 AND c>0 AND pos=0 THEN or=(e*4)
+c: IF zl(or)=1 THEN pos=pos+1: GO TO 269
275 IF ((e*4)+4=am OR (e*4)+1=am OR (e*4)+2=am OR
(e*4)+3=am) THEN AT am-(e*4), pos*26: STRIP 2: PRI
NT astre$(am): STRIP 0
276 IF KEYROW(1)=1 AND c>0 AND pos=1 THEN dn=(e*4)
+c: EXIT luck
277 IF e*4>28 THEN GO TO 269
278 FOR i=1 TO 4: IF zl((e*4)+i)=1 THEN AT i, pos*
26: STRIP 40: INK 7: PRINT astre$((e*4)+i): STRIP
0
279 END REPeat luck
280 END REPeat luck
281 IF zl(dn)=1 THEN tra
282 IF zl(dn)<>1 THEN atd
283 END DEFine
284 DEFine PROCedure tra: ka 2
285 a$=FILL$(' ',37): AT 7, 0: PRINT a$;za(or)\a$;
zb(or)\a$;zd(or)\a$;zc(or)\a$;ze(or)\a$;zf(or)\a$;
zj(or)\a$;zk(or): OVER-1: BLOCK 68, 79, 220, 70, 4
: OVER 0
286 AT 7, 0: PRINT 'INTERCEPTORS'\'SHIPS'\'SOLDIER
S'\'SATELLITES'\'LASERS'\'ASSETS'\'MANPOWER'\'GRAI
N': AT 6, 0: STRIP 4: INK 0: PRINT 'CATEGORY:','QU
ANTITY:','      AVAILABLE: ': INK 7: STRIP 0: BLOCK
 10, 79, 82, 70, 4: dt=0: lbl=79: ka 0
287 FOR lock=1 TO 8: src: END FOR lock
288 END DEFine
289 DEFine PROCedure src: BLOCK 10, lbl, 82, 70, 4
: AT lock+6, 14: OVER 1: INK 0: PRINT CHR$(188)!;:
 OVER 0: INK 7: INPUT dt$: er=1
290 IF CODE(dt$)>47 AND CODE(dt$)<58 THEN dt=dt$
291 IF CODE(dt$)<47 OR CODE(dt$)>58 THEN AT lock+6
, 16: PRINT '0'&FILL$(' ',5)&'(Default)': dt=0
292 SELect ON lock
293 =1: IF za(or)>=dt THEN za(or)=za(or)-dt: za(dn
)=za(dn)+dt: er=0: a0=dt
294 =2: IF zb(or)>=dt THEN zb(or)=zb(or)-dt: zb(dn
)=zb(dn)+dt: er=0: a1=dt
295 =4: IF zc(or)>=dt THEN zc(or)=zc(or)-dt: zc(dn
)=zc(dn)+dt: er=0
296 =3: IF zd(or)>=dt THEN zd(or)=zd(or)-dt: zd(dn
)=zd(dn)+dt: er=0: a2=dt
297 =5: IF ze(or)>=dt THEN ze(or)=ze(or)-dt: ze(dn
)=ze(dn)+dt: er=0
298 =6: IF zf(or)>=dt THEN zf(or)=zf(or)-dt: zf(dn
)=zf(dn)+dt: er=0
299 =7: IF zj(or)>=dt THEN zj(or)=zj(or)-dt: zj(dn
)=zj(dn)+dt: er=0
300 =8: IF zk(or)>=dt THEN zk(or)=zk(or)-dt: zk(dn
)=zk(dn)+dt: er=0
301 END SELect
302 IF er THEN AT lock+6, 16: STRIP 2: PRINT 'ERRO
R: ';: STRIP 4: INK 0: PRINT 'NO TRANSFER': PAUSE:
 AT lock+6, 16: STRIP 0: PRINT FILL$(' ', 20): loc
k=lock-1
303 END DEFine
304 DEFine PROCedure enemy: IF att>33 THEN att=0
305 zb(2)=(DATE-TIME)*10: zc(2)=(DATE-TIME)*12: zd
(2)=(DATE-TIME)*100: za(2)=(DATE-TIME)*20: ze(2)=(
DATE-TIME)*40: IF INT((DATE/23))*23=DATE THEN offe
nse
306 END DEFine
307 DEFine PROCedure offense: att=att+1: IF zl(att
)<>2 THEN wa=RND(za(2)/20000)*1000: wb=RND(zb(2)/2
0000)*1000: wd=RND(zd(2)/20000)*1000: a0=wa: a1=wb
: a2=wd: za(2)=za(2)-wa: zb(2)=zb(2)-wb: zd(2)=zd(
2)-wd: ad=att: PRINT#16, 'System '&astre$(ad)\'Und
er attack': attack
308 FOR i=1 TO 32
309 IF zl(i)=2 THEN za(i)=za(i)+za(2)/60: zb(i)=zb
(i)+zb(2)/60: zc(i)=zc(i)+zc(2)/60: zd(i)=zd(i)+zd
(2)/60: ze(i)=ze(i)+ze(2)/60: za(2)=za(2)*59/60: z
b(2)=zb(2)*59/60: zc(2)=zc(2)*59/60: zd(2)=zd(2)*5
9/60: ze(2)=ze(2)*59/60
310 END FOR i
311 IF victory=1 THEN zl(ad)=2: BLOCK#17, 4, 3, (z
o(ad)-1)*4, (zp(ad)-1)*3, 2: victory=0: IF zl(32)=
2 THEN write "You have failed your mission.": kb:
STOP
312 END DEFine
313 DEFine PROCedure write(m$): RECOL#13, 0, 1, 0,
 3, 4, 5, 6, 7: SCROLL#13, -10: STRIP#13, 2: AT#13
, 4, 0: PRINT#13, m$: END DEFine
314 DEFine PROCedure f9: BLOCK 150, 86, 144, 7, 4:
 AT 1, 24: OVER -1: PRINT ' Population: ';nm$(zj(a
m))\,,,' Assets:  ';nm$(zf(am))\,,,' Grain:    ';nm
$(zk(am))\:OVER-1:PRINT\,,,' Satellites: ';nm$(zc(
am))\,,,' Aircraft:    ';nm$(za(am))\,,,' Lasers:
   ';nm$(ze(am))\,,,' Mega Ships: ';nm$(zb(am)): O
VER 0
315 PAPER#16, 2: INK#16, 7: CLS#16: OVER#16, 1: PR
INT#16, ' Population:     ';nm$(zj(am))\' Assets:
      ';nm$(zf(am))\' Grain:          ';nm$(zk(am))
\' Modernity:      ';zg(am)\' Farming Tech.: ';zh(a
m): INK#16, 4: END DEFine
316 DEFine PROCedure intel: LOCal c, e: CLS: IF re
v=0 THEN or=am: STRIP 4: INK 0: PRINT astre$(am):
STRIP 0: INK 7: GO TO 327
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317 STRIP 2: AT 8, 0: PRINT 'Neutral': STRIP 4: IN
K 2: PRINT 'Allied ': STRIP 6: INK 0: PRINT 'Enemy
  ': STRIP 0
318 BLOCK 16, 40, 116, 10, 4: FOR i=1 TO 4: AT i,
0: INK (zl(i)+1)*2: c=0: e=0: PRINT astre$(i): END
 FOR i: STRIP 4: INK 0: AT 0, 0: PRINT 'DATA ON:',
'      ': INK 7: STRIP 0
319 REPeat luck
320 IF KEYROW(0)=2 THEN CLS: write '': RETurn
321 IF KEYROW(1)=64 THEN c=c+1: IF c<5 THEN AT c,
20: BLOCK 10, 40, 119, 10, 4: OVER 1: INK 0: PRINT
 CHR$(188): INK 7: OVER 0
322 IF e*4>28 THEN GO TO 318
323 IF c=5 THEN INK 0: FOR i=e*4+1 TO e*4+4: AT i-
(e*4), 0: PRINT astre$(i): END FOR i: c=1: e=e+1:
FOR i=e*4+1 TO (e*4)+4: INK (zl(i)+1)*2: AT i-(e*4
), 0: PRINT astre$(i): END FOR i: AT c, 20: BLOCK
10, 40, 119, 10, 4: OVER 1: INK 0: PRINT CHR$(188)
: INK 7: OVER 0
324 IF KEYROW(1)=1 AND c>0 THEN or=(e*4)+c: EXIT l
uck
325 IF ((e*4)+4=am OR (e*4)+1=am OR (e*4)+2=am OR
(e*4)+3=am) THEN AT am-(e*4), 0: STRIP 40: INK 4:
PRINT astre$(am): STRIP 0: AT am-(e*4), 0: PRINT a
stre$(am)
326 END REPeat luck
327 ka 2: AT 3, 16: INK 2: PRINT 'Interceptors: ';
nm$(za(or)): AT 4, 16: PRINT 'Ships: ';nm$(zb(or))
\,,'Satellites: ';nm$(zc(or))\,,'Troops: ';nm$(zd(
or))\,,'Lasers: ';nm$(ze(or))\,,'Assets: ';nm$(zf(
or))\,,'Morale: ';zi(or)\,,'Population: ';nm$(zj(o
r))\,,'Grain: ';nm$(zk(or))\,,'Position: ';zo(or)!
zp(or)\,,'Gravity: ';(zm(or)/10)&'g'
328 a=zl(or): IF a=1 THEN d$='ALLIED'
329 IF a=2 THEN d$='ENEMY'
330 IF a=0 THEN d$='NEUTRAL'
331 AT 2, 16: INK 4: PRINT 'Status: ';d$: INK 7: O
VER-1: BLOCK 170, 128, 90, 16, 2: OVER 0: ka 0: kb
: CLS: END DEFine
332 DEFine PROCedure lives: liv=liv-1
333 IF liv<1 THEN FOR i=1 TO 5: write 'No more liv
es': END FOR i: STOP
334 write liv&' lives left': END DEFine
335 DEFine PROCedure mem: IF (PEEK_L(163860)-PEEK_
L(163856)-4096)>78000 THEN GO TO 337
336 END DEFine
337 f$='.0/': SAv: CLEAR: suv: LOA: DELETE PRINT&'
.0/': RETurn
338 DEFine PROCedure atd: a$=FILL$(' ', 37): AT 7,
 0: PRINT a$;za(or)\a$;zb(or)\a$;zd(or): OVER-1: B
LOCK 68, 29, 220, 70, 4: OVER 0
339 AT 7, 0: PRINT 'INTERCEPTORS'\'SHIPS'\'SOLDIER
S': AT 6, 0: STRIP 4: INK 0: PRINT 'CATEGORY:','QU
ANTITY:','      AVAILABLE  ': INK 7: STRIP 0: BLOCK
 10, 29, 82, 70, 4: dt=0: lbl=29
340 FOR lock=1 TO 3: src: END FOR lock
341 ad=dn: write 'NOW ATTACKING '&astre$(ad): CLS:
 attack
342 IF victory=1 THEN zl(dn)=1: victory=0: za(dn)=
a0: zb(dn)=a1: zd(dn)=a2: a1=0: a2=0: a0=0: IF zl(
2)=1 THEN CLS: PRINT "IMPERIA Has finally been top
peled. Congratulations!": PAUSE: STOP
343 END DEFine
344 DEFine PROCedure ka(a): POKE 98403, a: END DEF
ine
345 DEFine PROCedure kb(b): PAUSE 50: PAUSE b: END
 DEFine
346 DEFine PROCedure kc(c): IF c=1 THEN BEEP 0, 18
, 0, 0, 0, 0, 25, 0
347 IF c=0 THEN BEEP 30000, 1, 19, 69, 81, 43, 29,
 0
348 END DEFine
349 DEFine PROCedure inputter
350 AT c+2, 27: INPUT q7$: IF q7$='' THEN GO TO 35
0
351 END DEFine
352 DEFine FuNction nm$(u):LOCal v$:v$=u: IF ABS(u
)>=1000 AND ABS(u)<1E6 THEN v$=INT(u)
353 IF ABS(u)>=1E6 AND ABS(u)<1E12 THEN v$=(u/1E6)
: v$=v$(1 TO 4)& ' million'
354 IF u<1000 THEN v$=INT(u)
355 IF ABS(u)>=1E9 THEN v$=(u/1E9): v$=v$(1 TO 4)&
 ' billion'
356 IF ABS(u)>=1E12 THEN v$=(u/1E12): v$=v$(1 TO 4
)& ' trillion'
357 IF u>=1E15 THEN v$=(u/1E15): v$=v$(1 TO 4)& '
quadrillion'
358 RETurn v$: END DEFine
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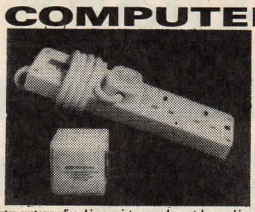

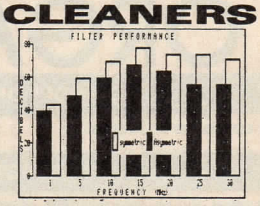

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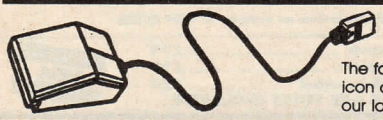

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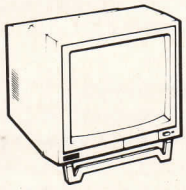

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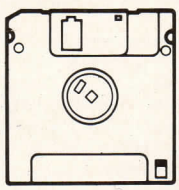

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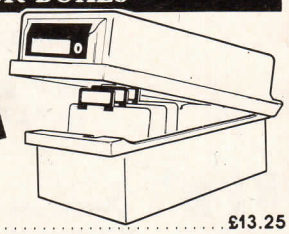

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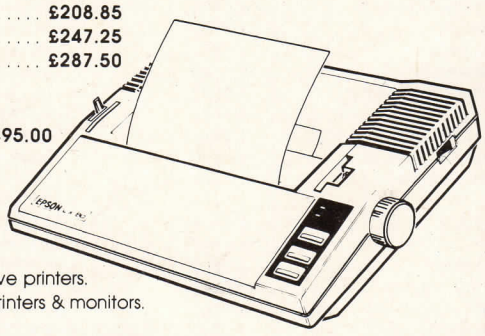

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